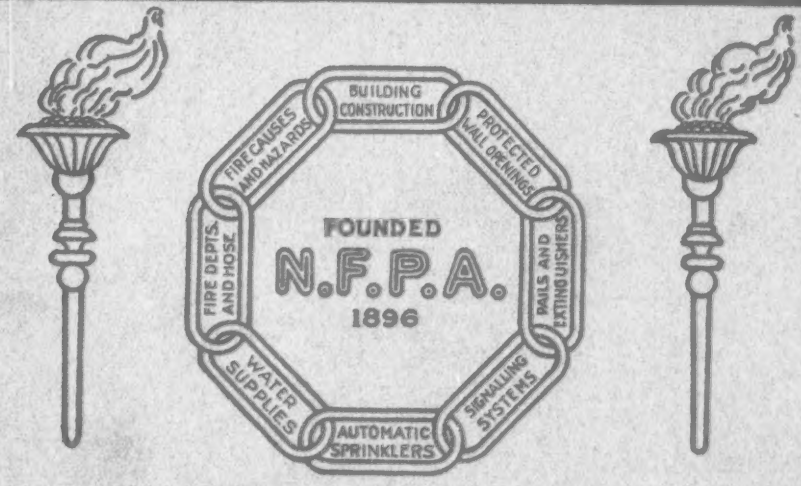
Vol. 29 JANUARY, 1936 No. 3

# QUARTERLY
OF THE

# NATIONAL FIRE PROTECTION ASSOCIATION




*"To Promote the Science and Improve the Methods of Fire Protection and Prevention."*

PUBLISHED QUARTERLY AT BOSTON, MASS., BY THE
NATIONAL FIRE PROTECTION ASSOCIATION

Printed in U. S. A.

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**PHILADELPHIA, PA.**

***Sales Offices in Principal Cities.***

Vol. 29 January, 1936 No. 3

# QUARTERLY

OF THE

# National Fire Protection Association

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# National Fire Protection Association

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# Table of Contents.


TACOMA HOTEL FIRE ..... FRONTISPIECE

EDITORIALS ..... 187

THE 1935 FIRE LOSS ..... 190

LARGE LOSS FIRES 1935 ..... 191

INDIVIDUAL LIABILITY FOR PREVENTABLE FIRES ..... 194

CHICAGO JUNIOR FIRE MARSHALS. *Photograph* ..... 196

THE TERMITE FIRE HAZARD. *C. M. Stegner* ..... 197

U. S. POST OFFICE BUILDING FIRE ..... 200

FIRE PROBLEMS OF AMERICAN AND FOREIGN CITIES. *Boris Laiming* ..... 202

OBSERVATIONS ON WIRING PRACTICES ABROAD. *M. G. Lloyd* ..... 209

FIRE DEPARTMENT RECORDS. *Percy Bugbee* ..... 213

ELECTRICAL THAWING OF FROZEN WATER PIPES ..... 223

TACOMA HOTEL FIRE. *Washington Surveying and Rating Bureau* ..... 227

GLIDDEN SOYBEAN PLANT EXPLOSION. *David J. Price and Hylton R. Brown* ..... 233

A RURAL SOYBEAN PLANT EXPLOSION. *David J. Price* ..... 240

PEORIA WHISKEY WAREHOUSE FIRE ..... 244

COOK PAINT AND VARNISH COMPANY FIRE ..... 247

LOS ANGELES COUNTY FOREST FIRES. *Spence D. Turner* ..... 255

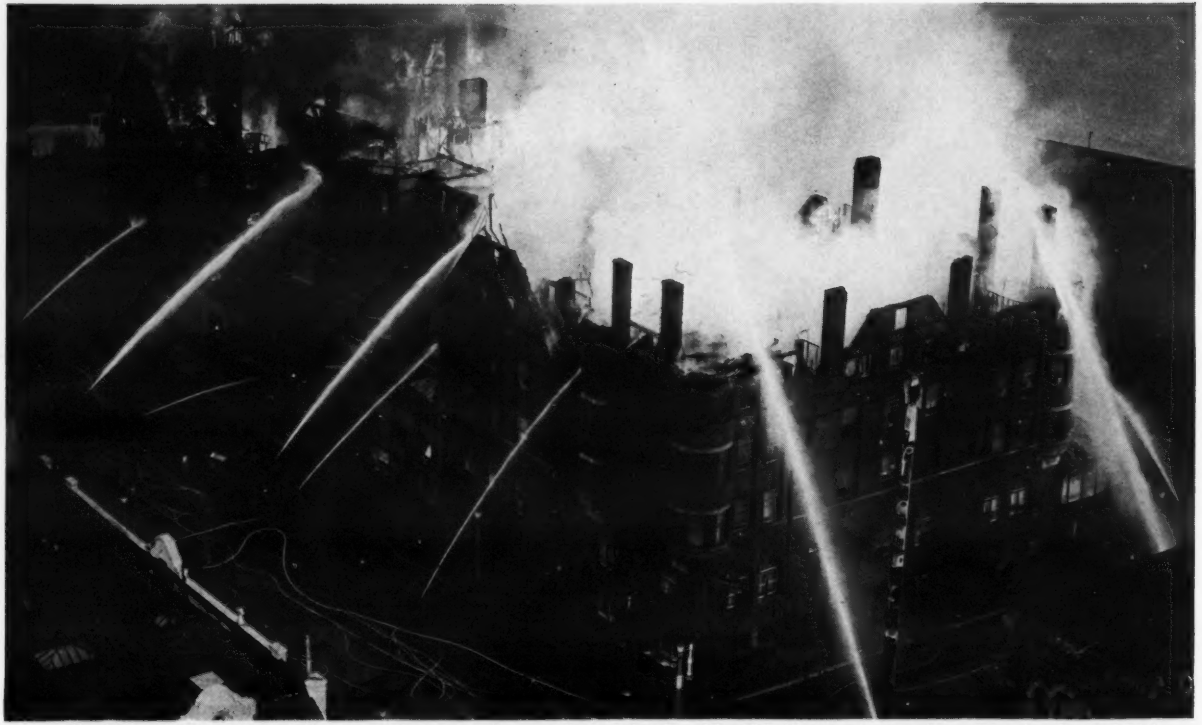
FATAL OIL HEATER FIRE, WEST ORANGE, N. J. *R. M. Cadman* ..... 262

AIR CONDITIONING AND VENTILATING FIRES ..... 264

LOSS OF LIFE BY FIRE 1930-1935 ..... 279

FIRES IN WHICH THERE WAS LOSS OF LIFE. *Fourth Quarter, 1935* ..... 285


*Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.*



The Tacoma Hotel fire at Tacoma, Wash., on the morning of October 17, 1935. Heavy streams from pumpers located at large mains one block distant are shown discharging through turret pipes on fire apparatus. This picture was taken at 7:40 a.m., approximately one and one half hours after the fire was discovered in the basement. The stream at the upper left of the picture is being discharged from a pipe on an aerial ladder. The huge totem pole at the right was installed when the hotel was erected in 1884 to bring

# The Quarterly

Vol. 29 January, 1936 No. 3

**Fingers Crossed.** The fire loss for the year 1935, according to preliminary estimates, continues the downward trend of the past few years and is the lowest total loss figure in twenty years. Fire protection authorities, while much gratified with this downward trend, have for the past two or three years been anticipating an increase in losses with improvement in business conditions. They fear that the low loss record may lull the public into a neglect of measures of fire prevention and fire protection and that a serious increase in fire losses may follow, and note an increase of a few per cent in the loss in the fall months of 1935 as compared with the similar period in 1934.

The decreasing fire loss trend of the past few years may be explained in a number of ways. No single factor can be given all the credit. Perhaps the most commonly advanced theory is that the depression period has so thoroughly deflated values that there is no longer an incentive to burn property for profit. Another theory is that the decrease in activity of manufacturing plants has reduced the normal number of fires in industry and that inventories have been so low that when fires have started losses have been smaller than in former years. The gradual increase in fire-resistive construction, the more widespread installation of automatic sprinklers, fire alarms and other fire protection equipment are registering an effect in decreased losses. Improved fire department efficiency is also doubtless a factor. There has been a gradual evolution of the municipal fire department. Today, instead of being merely water-throwers, many fire departments are truly interested in the reduction of losses and are devoting increasing attention to fire prevention activities, salvage and the control of the incendiary fire problem. The demolition and removal of dilapidated buildings as discussed in the following editorial, improved water supply, increasing attention to public education in fire prevention and various other factors have all doubtless exerted their influence on losses.

Many fire protection authorities, however, seem to feel that the continued decrease in the national fire waste is more than can be logically accounted for by these factors and caution against overoptimism. The factors responsible for the fire waste are so complex that no one has the temerity to predict the

The Tacoma Hotel fire at Tacoma, Wash., on the morning of October 17, 1935. Heavy streams from pumpers located at large mains one block distant are shown discharging through turret pipes on fire apparatus. This picture was taken at 7:40 a.m., approximately one and one half hours after the fire was discovered in the basement. The stream at the upper left of the picture is being discharged from a pipe on an aerial ladder. The huge totem pole at the right was installed when the hotel was erected in 1884 to bring good luck. (See report, page 227.)

future loss trend. It is only from the record of the next few years that we will be able to tell whether the present extreme drop in the fire loss curve is merely a temporary condition or a permanent reduction in the disgraceful fire waste so long suffered by the people of the United States and Canada.

* * * * * *

**One Good Reason for Less Losses.** In 1930, Fire Marshal Fred Roberts of Portland, Oregon, decided to rid his city of a lot of old dilapidated buildings that were potential fire and conflagration breeders. He secured the permission of the property owners to have the buildings removed without expense or liability to the owner. He then lined up building wreckers to remove the buildings, first having them secure the proper permit from the building department. The wreckers simply agreed to do the work to the satisfaction of the fire marshal, and to take for compensation the material and salvage in the old building. The plan cost neither city nor property owner any money. In the first fourteen months of this campaign 790 old buildings were condemned and razed in Portland. In 1934, 509 buildings were added to the list.

Back in 1926 the bureau of fire prevention in Providence, Rhode Island, launched a campaign to rid the city of buildings that were a positive menace to surrounding property. Backed by the Board of Fire Commissioners, the Inspector of Buildings, the local newspapers, and the courts, the campaign brought hundreds of this type of buildings down. Another similar drive in the last two years added over four hundred more.

Building Inspector Leon Gurda of Milwaukee has carried on a thoroughgoing campaign for the elimination of hazardous buildings in his city. His work was also sustained by the local courts. Since 1928, well over 2700 buildings have been razed.

A combined campaign of half a dozen civic agencies was launched in Chicago in 1934 to secure the demolition of 2000 unsafe buildings. Results have been excellent.

Some interested citizens surveyed the dilapidated buildings situation in Atlantic City, New Jersey, and in March, 1933, secured the adoption of a suitable ordinance giving the building inspector power to condemn such properties. In twelve months time 85 buildings, including a number of large hotel properties, were condemned and removed.

The city planning board of Lowell, Massachusetts, initiated an attack on old dangerous buildings in Lowell which has brought down 300 fire breeders in the last couple of years.

The building department in Pittsburgh, Pennsylvania, had 719 buildings condemned and razed in 1934.

A recent annual report of the Fire Prevention Bureau of Indianapolis says: "This department with the assistance of the Commissioner of Buildings and the State Fire Marshal, inspected a number of old dilapidated buildings. We gave orders for 557 of these to be repaired or wrecked. One hundred and ninety-six have been wrecked and the débris and rubbish removed. Many of the old buildings wrecked were in the congested high value district."

Efforts of the Superintendent of the Insurance Patrol and fire inspector of the fire department in Worcester backed by the fire prevention committee of the Worcester Safety Council have resulted in 600 old buildings being torn down since 1932.

Similar reports are at hand from Cincinnati and Youngstown, Ohio; Des Moines, Iowa; Hartford, Connecticut; Newark, New Jersey; Minneapolis, Minnesota; San Francisco, California; St. Louis, Missouri; Lexington, Kentucky; and Brockton and Springfield, Massachusetts. These are only a few. Progressive fire chiefs, fire prevention bureaus, building inspectors, planning boards, and fire prevention committees in many other cities are at work similarly removing the bad fire hazards in their communities.

Elsewhere in this issue of the QUARTERLY are the estimates for fire loss in 1935. The low loss record of the year, the lack of conflagrations and numerous large fires in congested districts of large cities may be in part explained by the widespread removal of the old "tinder boxes" formerly such a common sight in most American communities.

* * * * * *

**The New Handbook.** The publication of the eighth edition of the Crosby-Fiske-Forster Handbook of Fire Protection, just off the press, is another landmark in the development of fire protection engineering. The previous authors, E. U. Crosby, Henry A. Fiske and H. W. Forster, more than a year ago donated to the N.F.P.A. all their rights in the book which was last published privately in 1924. The new edition, a volume of over 1100 pages, brings up to date all the valuable material of the last edition, and covers the numerous new developments of the past decade. It is the result of contributions and suggestions from over a hundred N.F.P.A. members, more than a year of editorial work in the N.F.P.A. Executive Office, and a complete review of the manuscript by a committee appointed by the Board of Directors for this purpose, consisting of C. W. Mowry, Chairman, Eugene Arms, Henry A. Fiske, David J. Price, and A. R. Small. With the publication of the new Handbook, the position of the Association as the source for authoritative literature in the fire protection field is even more strongly established.

The Handbook shows the wide ramifications of the subject of fire protection, which is now an established branch of engineering comparable in importance to other specialized divisions of the general engineering field. The

extent of the subject of fire protection engineering is indicated by the fact that this eleven hundred page book presents only fundamental information of general application, in condensed form. If every subsidiary detail were included, each of the fifty-eight chapters might be expanded to make a book in itself. It is a reference volume useful alike to experienced fire protection engineers and to novices and contains much material not elsewhere available, but is not intended to supersede the numerous other N.F.P.A. publications which will be consulted, as before, for the complete detailed provisions applying to various individual subjects.

The new edition is receiving immediate recognition as the most valuable work in the fire protection field published to date. The Executive Office received orders for several hundred copies even before the book was off the press. It is a foregone conclusion that the new book will be universally regarded as an essential implement of the fire protection engineer's work, which should be in every library and on the desk of everyone who has to deal with the problem of fire prevention and fire protection.

# The 1935 Fire Loss.

The preliminary estimate of the fire loss of the United States for the year 1935 is $259,159,945. This is based on estimates by the National Board of Fire Underwriters. The estimated loss for 1935 is more than $7,000,000 less than that in 1934 and is the lowest figure reported since 1916.

**Comparative Monthly Loss Estimates, 1933, 1934, and 1935.**

| | 1933 | 1934 | 1935 |
|---|---|---|---|
| January | $35,547,565 | $28,002,583 | $23,430,504 |
| February | 36,661,481 | 31,443,484 | 25,081,025 |
| March | 35,321,248 | 31,312,359 | 24,942,703 |
| April | 27,825,970 | 22,028,943 | 23,267,929 |
| May | 24,338,714 | 25,271,459 | 21,238,205 |
| June | 21,578,609 | 20,005,692 | 18,499,095 |
| July | 20,004,049 | 19,484,027 | 19,293,619 |
| August | 23,626,505 | 19,613,146 | 18,137,000 |
| September | 20,447,571 | 16,243,870 | 16,641,882 |
| October | 21,465,382 | 18,236,272 | 19,785,871 |
| November | 22,454,200 | 20,114,346 | 20,871,584 |
| December | 27,626,439 | 23,895,879 | 27,969,288 |
| Total 12 months | $316,897,733 | $275,652,060 | $259,159,945 |
| Adjusted loss figures (Released later in year.) | $271,453,189 | $262,848,122 | |

It may be noted that the final adjustment loss figures for both 1933 and 1934 are less than the preliminary loss figures for those years. It may fairly be assumed, therefore, that the adjusted loss figure for 1935 may also be lower than the preliminary estimate.

### Aggregate Loss for Twenty Years Exceeds Eight Billion Dollars.

The 1935 fire loss brings the total direct fire waste of the United States during the past twenty years up to $8,413,980,536, an annual average of approximately $420,000,000. The following table gives the annual fire losses since 1916.

| | | | |
|---|---|---|---|
| 1916 | $258,377,952 | 1926 | $561,980,751 |
| 1917 | 289,535,050 | 1927 | 472,933,969 |
| 1918 | 353,878,876 | 1928 | 464,607,102 |
| 1919 | 320,540,399 | 1929 | 459,445,778 |
| 1920 | 447,886,677 | 1930 | 501,980,624 |
| 1921 | 495,406,012 | 1931 | 451,643,866 |
| 1922 | 506,541,001 | 1932 | 406,885,959 |
| 1923 | 535,372,782 | 1933 | 271,453,189 |
| 1924 | 549,062,124 | 1934 | †262,848,122 |
| 1925 | 559,418,184 | 1935 (Est.) | 255,190,657 |

## Large Loss Fires, 1935.

During the year 1935 there were thirty fires involving a loss reported at $250,000 or over, a decrease of four from the previous year. Four of these fires were forest and brush fires which occurred on the same day in various sections of Los Angeles County, Calif. The thirty fires occurred in various sections of the United States as shown on the accompanying map.

Of the large loss fires in 1935, the only ones which can be classed as group fires or conflagrations were the series of fires in Los Angeles County on October 23, which together destroyed a total of 222 buildings and caused losses of $3,617,835, including damage to watershed property. The fires during 1935 in which losses, according to the best information available, amounted to $250,000 or more occurred as follows:

| | |
|---|---|
| January 21, Kansas City, Mo. Terminal grain elevator | $283,000 |
| February 23-28, Dyersburg, Tenn. Cotton storage tents* | 313,000 |
| February 25, Detroit, Mich. High School (Quarterly, April, 1935, p. 329) | 582,000 |
| February 27, Steubenville, Ohio. Mercantile | 250,000 |
| March 1, Alva, Okla. State teachers' college | 313,000 |
| March 15, Savannah, Ga. Pier warehouse (Quarterly, April, 1935, p. 341) | 387,000 |
| March 16, Peoria, Ill. Whiskey distillery | 568,000 |
| March 27, New York, N. Y. Tenant manufacturing | 359,000 |
| April 19, Saginaw, Mich. City hall | 322,000 |
| April 20, Brooklyn, N. Y. Rubber warehouse (Quarterly, July, p. 65) | 300,000 |
| April 25, Salem, Ore. State capitol (Quarterly, July, 1935, p. 42) | 1,000,000 |
| May 12, Barrackville, W. Va. Coal mine | 250,000 |
| June 2, Erie, Pa. Railroad docks and warehouses | 360,000 |
| June 18, New Orleans, La. Department store and office building (Quarterly, October, 1935, p. 125) | 338,000 |

*Two large adjacent storage tents containing baled cotton were destroyed. One tent ignited on February 23, and on February 28, when burning cotton was still being overhauled, the second storage tent ignited and was destroyed. No definite connection between the two fires is known, although a spark may have carried from the first fire to start the second. The loss figure in the table is the total for both storage tents.

†A final adjusted figure for 1934 is not yet available.

| | |
|---|---|
| June 24, Fort Lauderdale, Fla. Yacht storage basin | 375,000 |
| June 24, Stockton, Calif. Stock feed mill (Quarterly, October, 1935, p. 167) | 400,000 |
| June 24, Deal, N. J. Dwelling | 450,000 |
| June 29, New York, N. Y. Apartment under construction | 250,000 |
| June 29, Philadelphia, Pa. Alcohol distillery | 250,000 |
| July 22, Peoria, Ill. Whiskey warehouse and distillery (Quarterly, January, 1936, p. 244) | 2,100,000 |
| October 3, Mexia, Texas. Cotton compress | 275,000 |
| October 7, Chicago, Ill. Soybean plant (Quarterly, January, 1936, p. 233) | 600,000 |
| October 17, Tacoma, Wash. Hotel (Quarterly, January, 1936, p. 227) | 320,000 |
| October 23, Los Angeles County. Forest and brush fires (Quarterly, January, 1936, p. 255): | |
| La Flores | 845,000 |
| Latigo | 1,464,000 |
| Kagel Canyon | 290,000 |
| Sherwood Lake | 1,218,000 |
| October 24, North Kansas City, Mo. Lacquer factory (Quarterly, January, 1936, p. 247) | 250,000 |
| November 9, Hinsdale, N. H. Paper mill | 381,000 |
| December 13, Cleveland, Ohio. Mail order warehouse and tenant manufacturing | 346,000 |

The following Canadian losses are reported to have amounted to $250,000 or more, an increase of two over 1934.

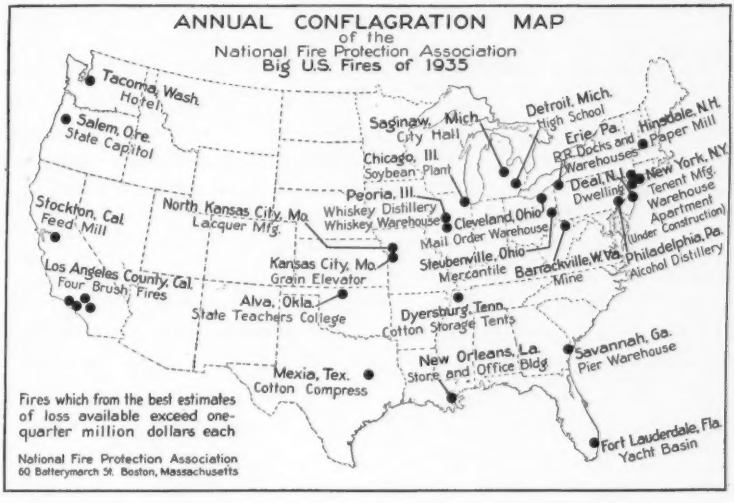
| | |
|---|---|
| February 20, Vancouver, B. C. Wholesale mercantiles | $259,000 |
| May 17, Joliette, P. Q. Convent | 350,000* |
| December 6, Hamilton, Ont. | 253,000 |

An analysis has been made of the reports of the thirty fires occurring in the United States to determine the factors that have been responsible for the large losses. Not all the losses can be attributed to one factor, and in some instances as many as four or five factors have contributed to a single large loss.

The factor most frequently responsible for large loss fires during the year was "inferior construction."

Although the importance of improved construction is clearly shown in the record it cannot be considered as a cure-all, as many large losses were due to highly combustible contents or excessive amounts of burnable materials, and other internal hazards such as flammable liquids. It is interesting to note that five of these fires originated in buildings of fire-resistive or semi-fire-resistive construction. In most of these cases the building damage was but a small fraction of the total loss, which was due to hazards of occupancy or excessive amounts of combustible stock. Defects in the structural arrangement of several of these buildings were, however, contributing factors to the losses.

*Based on newspaper estimates, as no exact figure was available at time of publication.


ANNUAL CONFLAGRATION MAP
of the
National Fire Protection Association
Big U.S. Fires of 1935
Tacoma, Wash. Hotel
Salem, Ore. State Capitol
Stockton, Cal. Feed Mill
Los Angeles County, Cal. Four Brush Fires
North Kansas City, Mo. Lacquer Mfg.
Kansas City, Mo. Grain Elevator
Alva, Okla. State Teachers College
Mexia, Tex. Cotton Compress
Saginaw, Mich. City Hall
Chicago, Ill. Soybean Plant
Peoria, Ill. Whiskey Distillery
Whiskey Warehouse
Cleveland, Ohio Mail Order Warehouse
Steubenville, Ohio Mercantile
Barrackville, W.Va. Mine
Detroit, Mich. High School
Erie, Pa. RR. Docks and Warehouses
Deal, N.J. Dwellings
Hinsdale, N.H. Paper Mill
New York, N.Y. Tenant Mfg. Warehouse Apartment (Under Construction)
Philadelphia, Pa. Alcohol Distillery
Dyersburg, Tenn. Cotton Storage Tents
New Orleans, La. Store and Office Bldg.
Savannah, Ga. Pier Warehouse
Fort Lauderdale, Fla. Yacht Basin
Fires which from the best estimates of loss available exceed one-quarter million dollars each
National Fire Protection Association
60 Batterymarch St. Boston, Massachusetts

## Reasons for Large Loss.

| | No. of Fires |
|---|---|
| Inferior construction, excessive areas, etc. | 11 |
| Ineffective fire fighting | 9 |
| Fire department delayed in getting to work | 3 |
| Failure of private protection | 3 |
| Fire department pumpers took water from sprinklers | 2 |
| Inefficient fire fighting | 1 |
| Headway of fire when discovered | 7 |
| Unprotected vertical openings | 7 |
| Highly combustible contents or excessive amounts of burnable materials | 5 |
| Point of origin difficult of access for fire fighting | 5 |
| Inadequate water supplies | 4 |
| Large quantities of flammable liquids | 4 |
| Unfavorable weather conditions | 4 |
| Delayed alarm | 3 |
| Alarm not given promptly | 2 |
| Private alarm box made inaccessible by fire | 1 |
| Explosions | 3 |
| Lack of exposure protection | 2 |
| Susceptibility of contents to water damage | 2 |
| Lack of adequate public protection | 2 |
| Lack of adequate private protection | 2 |
| Failure of fire doors or shutters | 2 |
| Incendiary fires started in several locations | 1 |
| Building under construction, wooden lath exposed | 1 |
| Collapse of building broke sprinkler piping | 1 |
| Ventilating fans spread fire | 1 |

# Individual Liability for Preventable Fires.

The resumption of the activity of the Committee on Public Information aimed at securing the passage of ordinances to fix the cost of extinguishing fires upon persons disobeying fire prevention orders is awakening considerable interest throughout the United States and Canada. Demands for copies of the revised pamphlet on this subject are in fact coming from members in all parts of the world, who are always interested in what the U. S. is up to. This idea has obviously grown in public favor during the past decade.

Beside the state law of Pennsylvania the State of California enacted in 1931 a statute not so complete as that of the Quaker state, but recording the principle of making offenders pay for fire fighting. Following is the California law:

**Senate Bill No. 490**

*Chapter 790*

**An Act Defining the Civil Liability for Failure to Control Fire**

*(Approved by the Governor, June 12, 1931)*

*The people of the State of California do enact as follows:*

SECTION 1. Any person who:

(1) Personally or through another, and

(2) Wilfully, negligently, or in violation of law, commits any of the following acts:

(1) Sets fire to,

(2) Allows a fire kindled or attended by him to escape to the property, whether privately or publicly owned, of another is liable to the owner of such property for the damages thereto caused by such fire.

SECTION 2. Any person who allows any fire burning upon his property to escape to the property, whether privately or publicly owned, of another, without exercising due diligence to control such fire, is liable to the owner of such property for the damage thereto caused by such fire.

SECTION 3. The expenses of fighting such fires shall be a charge against any person made liable by this act for damages caused thereby. Such charge shall constitute a debt of the person charged and shall be collectible by the party, or by the federal, state, county, or private agency incurring such expenses in the same manner as in the case of an obligation under a contract, expressed or implied.

Our influential members in Canada, led by J. Grove Smith, Dominion Fire Commissioner, secured the passage of an act in 1919, which, while it does not provide for assessing the costs of fire fighting upon the offender, emphasizes very positively the liability which in the United States is usually understood to reside in the common law. The Dominion act is as follows:

**9-10 GEORGE V.**

**CHAP. 15.**

**An Act to amend the Criminal Code respecting prevention of Fire.**

[*Assented to 6th June, 1919.*]

His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1. Section five hundred and fifteen of the *Criminal Code* is amended by inserting the following subsection immediately before subsection two thereof:—

"(1A) Every one is guilty of an indictable offence and liable to two years' imprisonment who by negligence causes any fire which occasions loss of life or loss of property.

"The person owning, occupying or controlling the premises in which such a fire occurs, or on which such fire originates, shall be deemed to have caused the fire through negligence if such person has failed to obey the requirements of any law intended to prevent fires or which requires apparatus for the extinguishment of fires or to facilitate the escape of persons in the event of fire, if the jury finds that such fire, or the loss of life, or the whole or any substantial portion of the loss of property, would not have occurred if such law had been complied with."

2. The said Act is further amended by inserting immediately after section five hundred and fifteen the following section:—

"515A. When any Dominion, Provincial or Municipal fire officer or authority recommends to the owner, lessee or other person controlling or operating any building, structure, factory, shipyard, vessel, dock, wharf, pier, sawmill, or yard in which logs or lumber are stored or held, that any reasonable change, alteration or addition should be made in or to such building, structure, factory, shipyard, vessel, dock, wharf, pier, sawmill, or yard with a view to safeguarding life or property from destruction by fire, or that any material should be removed therefrom with such view, or that any apparatus should be supplied therefor with such view; and if such recommendation is approved by an officer in the service of His Majesty, thereto, authorized by the Governor in Council; and if notice of such recommendation and approval has been personally served upon such owner, lessee or other person; and if, after the expiration of thirty days from the receipt of such notice, such owner, lessee or other person refuses, neglects or otherwise fails to carry out such recommendation to the satisfaction of the officer in the service of His Majesty hereinbefore mentioned, such owner, lessee or other person shall be guilty of an indictable offence and shall be liable to a fine of not exceeding one thousand dollars, or to imprisonment for any term not exceeding six months, or to both such fine and imprisonment."

Notwithstanding the establishment of criminal liability by this statute the plan to fix the cost of fire extinguishment upon the offender appeals to our Canadian members as being less severe, but perhaps quite as effective as the criminal code liability. A civil code penalty is more likely to be agreed to by a jury than criminal punishment. We should not be surprised if a number of Canadian cities may be inclined to follow the lead of United States cities in adopting ordinances assessing the offender for any unnecessary use of the fire department.

## Chicago Junior Fire Marshals.

The Fire Prevention Committee of the Chicago Association of Commerce in coöperation with the Superintendent of Schools of Chicago has secured the appointment of a fire marshal from each of the thirty-seven high schools in Chicago. The photograph shows the group at the organization meeting held during Fire Prevention Week, 1935. In the second row are Chief Fire Marshal Michael J. Corrigan of the Chicago Fire Department (fourth from left), Chief Frank C. McAuliffe, Chairman of the Fire Prevention Committee and Superintendent of the Chicago Salvage Corps (fourth from right), State Fire Marshal Sherman V. Coultas of Illinois (third from right), and Deputy Chief Fire Marshal Anthony J. Mullaney of Chicago Fire Department (end of row on right). The Flower Technical High School, the only all-girls school, is represented by Fire Marshal Carol Dostal (fifth from left in second row).

The group is to hold regular meetings to discuss ways and means of spreading the gospel of fire prevention in their schools and in the homes in each school district. The group has drawn up its own by-laws and elects its own officers. The meeting of the group on October 26 was addressed by Assistant Managing Director Bugbee. Students with special qualities of leadership were selected by each school for this important assignment. Fire Marshal Coultas presented each one with a special Junior Fire Marshal badge.

# The Termite Fire Hazard

By C. M. Stegner (Member N.F.P.A.),
Commissioner of Buildings, Cincinnati.

Fossil termite remains in American rock show that these scavenger insects antedate man. While termites cannot be charged directly with incendiarism, their contribution to building fire hazards is by no means imaginary. To the layman, termites are white ants and their damage to wood is frequently mistaken for dry rot or decay. To the building official termite damage is a most serious problem that has received but little consideration as a fire hazard.

A recent illustration of a termite fire hazard that might have caused a $5,000,000 conflagration occurred in a Cincinnati distillery. Evidence of termite infestation was found in seven adjoining brick and timber unsprinklered buildings used for whiskey warehouse purposes. The local branch of a nationally experienced termite exterminating company was employed under a guarantee contract. The exterminating process consisted in locating all termite nests or points of termite access to the earth, and then treating these locations with a poisonous liquid. This liquid was applied from a compressor through a hose terminating in a ⅛-inch pipe and nozzle which was under a pressure of 150 lbs. per square inch. The pipe was inserted into tight fitting holes drilled in the wood at strategic points for the purpose of poisoning the termites in their nests. Masonry wall cracks and other surfaces were sprayed where suspected as possible points of termite access on their journeys to the earth for moisture.

One building had been treated and work on the second was nearly completed. All exploration and treatment operations were confined to the basements of the buildings with the idea of preventing future contact of the termites with the earth and thereby depriving them of the necessary moisture, which would soon result in their extermination. The basement in which the accident occurred was an unpaved and unused area about 60 x 80 ft. and 8 ft. high. A movable scaffold was dragged around over the ground to reach the ceiling timbers supporting the first floor. The only basement wall openings were two small high windows on one side which severely restricted light and ventilation. Illumination was supplied by an ordinary 200-watt electric lamp on an extension cord hung over a nail on the scaffold.

In moving the scaffold the electric lamp fell to the ground and broke. The glowing lamp filament started a flame which ran over the saturated wood and instantly converted the entire basement into a blazing smoke filled furnace. The plight of the two termite exterminators was soon discovered by distillery employees, who came to their rescue after turning in a fire alarm.

Both of the victims collapsed from inhaling the hot fumes and were sent to the hospital. The Cincinnati fire department responded promptly and soon had the blaze under control. Failure to have done this might have resulted in a very serious distillery fire that would have boosted the Cincinnati fire loss above any past record.

The employees of the exterminating company could account for the fire only as the result of a broken lamp. They did not know the ingredients of the exterminating fluid which had an Underwriters' Laboratories classification with kerosene several years ago. The subsequent analysis of a sample furnished by their manager showed a mixture of 85% kerosene or mineral spirits, 12.5% orthodichlorobenzene and 2.5% residue. About 26 gallons of the liquid had been sprayed into and around the timber in 4 hours. The flash point of the mixture was 115° F., open cup, and the temperature of the basement before the fire was about 70°.

The exterminators stated that the blaze started from the incandescent filament when the lamp broke. There had been little or no ventilation in the basement during the spraying and partial evaporation of 26 gallons of the flammable fluid. Since the flash point of the liquid at 115° was 45° higher than the atmospheric temperature, the ignition was not due to a flammable vapor from the exterminating fluid. The flash point of a flammable liquid or the temperature at which it will give off combustible vapors is quite different from the ignition temperature of a sprayed combustible mixture. In a cold furnace the pilot light in an oil burner will ignite sprayed oil having a flash point of 400° to 500° F. Pulverized fuel with a flash point of 1000° F. is readily ignited when sprayed over a pilot light. It is therefore probable that the distillery flash resulted from a fine oil spray retained in the confined basement atmosphere.

A diligent search of many municipal ordinances and of the National Board of Fire Underwriters regulations offers no regulation for the control of fire hazards in the prevalent uses of exterminator fluids. A collection of 17 samples from as many local operators shows all of them flammable, with flash points varying from 80° to 200° F.

The Bureau of Entomology, U. S. Department of Agriculture, has done valuable and extensive work on termite research, prevention and extermination. In connection with poisoning fluids referred to in their publications little stress was laid on the flammable constituents of orthodichlorobenzene, creosote and kerosene which were prescribed as precautions against future attack and not as primary means for extermination.

The wood handbook of the Forest Products Laboratory, U. S. Department of Agriculture, recommends powder termite eradicators such as paris green, arsenical dust, or sodium fluosilicate for lumber damage that does not necessitate replacement. The recommended liquid preservatives for wood are

(1) those of an oily nature and relatively insoluble in water, (2) salts soluble in water, (3) toxic constituents in volatile solvents other than water.

Creosote is the most important and useful preservative of the first group. It is a tar oil from coal, petroleum or timber that increases the flammability of the treated wood while the volatile oil constituents are present. The odor of creosote may be objectionable in residence construction or commercial buildings used for food product occupancy. Another objection to creosoted lumber is its inability to take paint.

The recommended salts soluble in water are zinc chloride, sodium fluoride, copper sulphite and mercuric chloride. Zinc chloride is the most generally used water solution at 3 to 5%. It is cheap, readily available, odorless and somewhat fire retardant. The zinc chloride treatment for wood does not interfere with the taking and retention of paint. Painting is necessary to retain a water soluble salt where wood is subject to moisture. The sodium fluoride, copper sulphate and mercuric chloride solutions are more expensive and therefore less frequently used.

The principal volatile solvents other than water are petroleum oils that vary from the crude, through fuel oil, kerosene, mineral spirits and naphtha, with corresponding flash points varying from 500° to –50° F. The lower flash point solvents create a serious fire hazard when used in occupied buildings. This fire hazard may be reduced by the admixture of a non-flammable liquid such as carbon tetrachloride which, however, may evaporate either more or less rapidly than the petroleum oil and still leave some hazard. Most of the commercial liquid insecticides are highly flammable but few, if any, are more effective than creosote or zinc chloride.

Failure to discover and repair the damage from termite infestations increases fire and safety hazards because the honeycombed remains of solid timbers have been reduced to little more than hollow shells. This assists an experienced termite hunter in testing suspected lumber with a sharp instrument that can be forced through the surface because termites live and work under cover. Solid timber ignites slowly in comparison with honeycombed or shredded wood. Fire stopping in wood frame buildings of wood blocking to prevent a flue action between timbers becomes valueless after termites get into it. The termites will also eat insulation from electric wiring, thereby permitting short circuits. They have been known to go through books and records from cover to cover even in fire-resistive buildings. All that is necessary is a small wall, window, pipe, or other opening for ingress to a few workers or a pair from a roving swarm. Fire hose is also a choice morsel, in fact, they will devour anything containing cellulose, which is quite common in buildings and their contents.

Fire prevention, building and insurance inspectors should learn the difference between termite infestations and dry rot. Building codes and insur-

ance regulations should have mandatory provisions for termite prevention and extermination. Fluids used by exterminators should not be permitted to create a serious fire and life hazard through large quantities of sprayed flammable liquids that may be accidentally touched off by a spark or open flame.

Municipal regulations for extermination should license all operators. Permits should be required to show the time of treatment and location of every exterminating job. Methods and materials should be prescribed for safe and effective work. Orders should be enforceable to prevent additional infestation from existing colonies or swarms. This will require new educational matter for our fire prevention campaigns.

NOTE: The N.F.P.A. Model Fumigation Ordinance contains certain provisions which may be applied to the control of this hazard, and the Committee on Fumigation Hazards is now studying termite control methods with a view to issuing a report on this subject.—Ed.

# U. S. Post Office Building Fire.

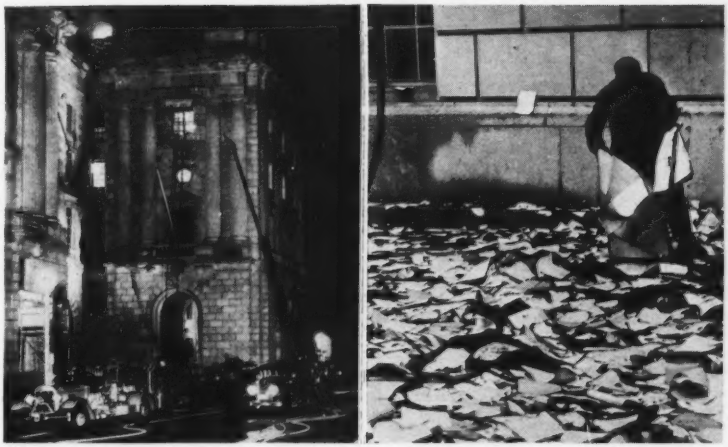
Fire which occurred in a record room on the sixth floor of the new eleven million dollar building of the U. S. Post Office Department in Washington, D. C., shortly before midnight on December 12, 1935, required seven hours work by firemen called on six alarms before it was controlled, and caused damage estimated at $30,000 exclusive of record losses.

This fire again raises the issues of adequate protection for valuable public records; the desirability of eliminating worthless records frequently kept due to a lack of definite procedure for their disposal; and the advisability of giving the District of Columbia Fire Department authority over fire hazards in Federal buildings in Washington which at present are not inspected by the Fire Department.

The Post Office department building is a seven-story fire-resistive structure. The fire occurred in a record room on the sixth floor occupied largely by files of the General Accounting Office. These files consisted of open wooden racks closely spaced and piled high with papers, books and other records bound in cardboard. The room had no windows or ventilators, but there were a number of doors along the corridor. The room was without automatic sprinkler or alarm service.

The fire was discovered by a building guard at 11:35 P.M. He sounded a local alarm, which brought other guards who attempted to subdue the fire with two standpipe hose streams. Finding that they could not control the fire, they called the fire department just before midnight. Within the next two hours five additional alarms were sounded to replace men incapacitated by smoke, and outside assistance was called to cover vacated stations.

The fire was most severe in an area about fifty by fifty feet, but also caused some damage in aisles extending thirty feet farther to one side. It did not go beyond a restriction at a stairway to a longer and narrower filing space



*Keystone.*

**Left: Exterior view of the U. S. Post Office Department building in Washington, D. C., during the fire in a record room on the sixth floor. Right: Charred records from the General Accounting Office files, thrown into the street during the fire.**

about 200 feet long. The fire was controlled only after holes were cut in the cement floor above, and distributor nozzles placed in operation. Forty-one firemen required hospital treatment as a result of smoke and carbon monoxide fumes. Due to the lack of ventilation firemen could work only a few minutes at a time.

The cause of the fire has been attributed to a portable 100 watt electric light bulb in contact with papers, or papers around the ceiling lights.

The property damage was about $30,000, including damage to inventoried contents. A large part of the damage to building and contents other than files was water damage. The consequence of the loss of the records has not been determined. Fortunately the records covered only closed accounts, and copies of a considerable portion of the papers would be present in other government offices, since the General Accounting Office passes on all expenditures which originate in the various departments. The Federal statute of limitations would enter into any damage suits, since the most recent papers involved date back sufficiently far to make the statute effective. There were also some records of the U. S. Geological Survey involved in the fire, the nature of which has not been reported.

NOTE: The N.F.P.A. Committee on Protection of Records recommends, among other provisions, that record rooms be limited in size to 40,000 cubic ft., that all records be stored in closed metal containers, that lighting circuits be controlled by switches outside the room and provided with an indicator, and that no extension cords be used, and also recommends automatic fire extinguishing or detecting equipment where conditions favor the start or spread of fire.—Ed.

# Fire Problems of American and Foreign Cities.

By Boris Laiming,
(Member N.F.P.A.).

The purpose of this article is to present the problem of fire waste in a group of major cities of the world in relation to frequency and intensity of fires, and fire department organization.

The data assembled below are the result of a detailed analysis of statistics of fires, fire losses, and fire department organization and operations in about forty large cities in the United States and in foreign countries.* Considerable diversity exists in the manner of presentation of the data by various agencies interested in the problem, and certain limitations are naturally placed upon the drawing of satisfactory comparisons between the different cities. For that reason, the loss figures given must be considered only approximate, as they are affected by uncertainties introduced by foreign exchange values, and comparisons between the different types of fire department organization are accurate only in so far as diversity in the types of equipment and methods will permit.

The per capita basis conventionally used to demonstrate the relative amount of loss from fire in given cities cannot be considered an adequate criterion for making comparisons between American and foreign cities in regard to the relative value of their fire defenses. Frequency and intensity of fires, property values at stake, and potential fire hazards created by prevailing types of building construction and occupancy have an important bearing upon the total fire waste and upon the amount of public fire protection needed. American cities are faced with a much greater fire problem than foreign cities, both in number of fire outbreaks and their intensity, resulting from quick burning construction, and therefore must maintain larger fire departments equipped to handle the existing emergency.

## Explanation of Tables.

Table I presents graphically the monetary loss per capita and per fire in 32 major cities of the world. Averages are worked out by division of the sum of all figures in each column by the number of cities for which figures are available. Current rates of exchange at time of report are used in computa-

*Annual reports of the fire departments, publications by the United States Bureau of the Census, the National Fire Protection Association, the National Board of Fire Underwriters, the German Association of Fire Engineers, and others covering the years 1929 to 1934 have been consulted in the preparation of this article.

tion of the figures for foreign cities presented in the table in terms of their American Dollar equivalent.

Table II contains an analysis of alarms and fires in different cities. It is assumed that the amount of equipment brought into action to extinguish the fires is a measure of their intensity. On that basis the fires are divided into two groups, small fires extinguished without hose lines or major equipment, and fires extinguished with hose lines. The latter appear in the table, and are grouped under three headings in terms of percentages of the total number of fires in each city.

Table III gives a summary of fire department organization in the cities under investigation. In view of the differences in the types and denominations of fire fighting apparatus in various cities it has been found necessary to establish a standard basis for comparison by defining a "fire fighting unit." The

**Table I. Fire Losses.**

| Year of Report | Population in Thousands (000 omitted) | City | Fire Loss Per Capita | Fire Loss Per Fire |
|---|---|---|---|---|
| 1934 | 1028 | Birmingham | $0.82 | $421 |
| 1933 | 1176 | Bombay | .32 | 1,262 |
| 1934 | 256 | Bordeaux | .54 | 607 |
| 1934 | 326 | Bremen | .77* | 722* |
| 1933 | 2000 | Calcutta | .38 | 1,725 |
| 1932 | 643 | Dresden | .08* | 149* |
| 1934 | 1111 | Glasgow | .72 | 851 |
| 1934 | 1129 | Hamburg | .11* | 95* |
| 1933 | 714 | Leipzig | .15* | 246* |
| 1933 | 856 | Liverpool | 1.81 | 1,634 |
| 1933 | 4397 | London | .88 | 663 |
| 1933 | 572 | Lyons | .34 | 171 |
| 1934 | 1053 | Milan | .32 | 617 |
| 1933 | 263 | Oslo | 1.99* | 1,422* |
| 1934 | 1647 | Shanghai | .18 | 363 |
| 1933 | 522 | Stockholm | .59* | 422* |
| 1933 | 414 | Stuttgart | .36 | 451 |
| 1934 | 1854 | Vienna | .09 | 197 |
| Average (Foreign cities) | | | $0.58 | $668 |
| 1933 | 805 | Boston | $2.93* | $376* |
| 1933 | 3475 | Chicago | 1.64 | 279 |
| 1933 | 300 | Columbus, O. | .39 | 66 |
| 1934 | 300 | Denver | 1.11 | 161 |
| 1933 | 1383 | Detroit | 1.37 | 190 |
| 1934 | 1275 | Los Angeles | .75 | 111 |
| 1934 | 612 | Milwaukee | 1.05 | 184 |
| 1934 | 472 | New Orleans | .65 | 197 |
| 1933 | 7346 | New York | 1.88 | 525 |
| 1933 | 700 | Pittsburgh | .64 | 159 |
| 1934 | 318 | Portland, Ore. | 1.98 | 203 |
| 1934 | 395 | Seattle | 1.58 | 213 |
| 1934 | 495 | Washington | .60 | 81 |
| 1934 | 1175 | Montreal | 1.83* | 629* |
| Average (North American cities) | | | $1.31 | $241 |

*Represents insurance loss only.

term, as used in this article, implies an operating unit consisting of one or two pieces of automotive fire apparatus with an average manual strength of 5 to 8 men, designated in American cities as a company. Included in the total of fire fighting units in each city are engine, hose, ladder (truck), fire boat, and full crew squad companies. Full crew salvage units are separately classified in the table. In foreign cities, an operating unit consisting of a combination pumping engine and an aerial ladder is considered the equivalent of two American companies. Escape vans in British cities, and booster wagons in French and other continental cities are also considered equal to one fire fighting unit as here adopted. Equipment designated in German and Scandinavian cities as "Mannschaftswagen" is considered equivalent to an American squad company in the sense used in the city of Chicago, and representing an emergency reserve of men and special equipment. Auxiliary apparatus, such as water towers, boat tenders, foam or straight chemical wagons, ventilators, and similar apparatus, are generally manned by a skeleton crew of only one or two men and serve special purposes. This apparatus and squad and salvage apparatus are not included in the totals of fire fighting units in Table III, but are recorded in the last column on the right. The figures under the heading "Classification of Fire Apparatus" include equipment in reserve.

Table IV contains data on fire prevention work performed by various fire departments. Lack of uniformity in recording of the data by the different cities makes it impossible to present a complete account of fire prevention work without extensive local study.

## Conclusions.

An examination of the tables leads to several interesting conclusions regarding the fire problem in large cities.

The loss per fire proves to be much smaller in North American cities than in the majority of foreign communities. It averages $241 for a group of 14 American cities, and compares with $668 for a group of 18 foreign cities (Table I).

Comparison of the fire loss per unit of property value is made difficult by reason of diversity in the manner of presentation of the values. Estimated true values are available for United States cities. One city in Canada and one in China report assessed values. Four British cities report rateable values. Three German, one British, and one Norwegian city report insured values only. If rateable values are capitalized at 5 per cent, and the assumption made that a ratio between total insurance value and insurance loss is broadly comparable to a ratio between true (capital) value and total fire loss (insured and uninsured), some idea of the relationship between fire losses and property values may be gained. On that basis, the loss per $1000 of all property value is found to fluctuate between $0.06 and $2.56 in a group of 10 foreign cities,

## Table II. Fires and Manner of Extinguishment.

| Year of Report | City | Total No. of Alarms | Total No. of Fires | Number of Fires per 1000 Population | Percentage of Total Number of Fires Extinguished: With 1 or more Hose Lines Per Cent | With 2 or more Hose Lines Per Cent | With more than 3 Hose Lines Per Cent |
|---|---|---|---|---|---|---|---|
| 1933 | Amsterdam ..... | 4,332 | 1,914† | 2.46 | 15 | ... | 1.4 |
| 1933 | Berlin ..... | 13,177* | 3,604 | .85 | 26 | 6.7 | .. |
| 1934 | Birmingham ..... | 1,944 | 1,768 | 1.72 | .. | ... | .. |
| 1933 | Bombay ..... | 400 | 300 | .25 | 40 | ... | .. |
| 1934 | Bordeaux ..... | .... | 228 | .89 | 56 | 10.0 | 2.6 |
| 1934 | Bremen ..... | 825* | 349 | 1.07 | 22 | 5.7 | .. |
| 1933 | Brussels ..... | 789 | 691† | .91 | 17 | 5.6 | 1.7 |
| 1933 | Calcutta ..... | 577 | 440 | .22 | 31 | ... | .. |
| 1933 | Cologne ..... | 2,178* | 970 | 1.28 | 16 | 4.7 | .. |
| 1934 | Copenhagen ..... | 1,283 | 892 | 1.39 | 21 | 8.0 | 1.5 |
| 1932 | Dresden ..... | 1,180* | 355 | .55 | .. | ... | .. |
| 1931 | Düsseldorf ..... | 829* | 424 | .88 | 19 | 5.6 | .. |
| 1934 | Glasgow ..... | 2,336 | 949 | .85 | 25 | ... | 1.6 |
| 1934 | Hamburg ..... | 4,103* | 1,319 | 1.17 | 14 | 3.3 | .7 |
| 1933 | Leipzig ..... | 1,332* | 447 | .63 | 20 | 3.4 | .. |
| 1933 | Liverpool ..... | 1,144 | 950 | 1.11 | .. | ... | .. |
| 1933 | London ..... | 8,742 | 5,877 | 1.34 | 27 | ... | .. |
| 1933 | Lyons ..... | 1,434 | 1,137† | 1.98 | 12 | 5.0 | .6 |
| 1934 | Milan ..... | 668 | 546 | .52 | .. | ... | .. |
| 1933 | Munich ..... | 496 | 255 | .35 | 28 | 8.6 | 3.0 |
| 1933 | Oslo ..... | .... | 368 | 1.40 | .. | ... | .. |
| 1933 | Paris ..... | 11,691 | 8,203† | 2.83 | 14 | 1.3 | .3 |
| 1934 | Shanghai ..... | 1,000 | 850 | .51 | .. | ... | .. |
| 1933 | Stockholm ..... | 884 | 725 | 1.39 | .. | 5.7 | .. |
| 1933 | Stuttgart ..... | 414 | 333 | .80 | .. | ... | .. |
| 1934 | Sydney ..... | 2,966 | 2,120 | 1.63 | .. | ... | .. |
| 1934 | Vienna ..... | 4,253* | 868 | .47 | .. | 2.8 | .. |
| Average (Foreign cities)..... | | | | 1.09 | 24 | 5.5 | 1.5 |
| 1933 | Boston ..... | 9,093 | 6,270 | 7.80 | 19 | ... | .. |
| 1930 | Chicago ..... | 32,602 | 25,331 | 7.50 | 22 | 4.4 | 1.0 |
| 1933 | Columbus, Ohio... | 1,945 | 1,773 | 5.91 | .. | ... | .. |
| 1934 | Denver ..... | 2,401 | 2,069 | 6.89 | .. | ... | .. |
| 1933 | Detroit ..... | 13,683 | 9,978 | 7.21 | .. | ... | .. |
| 1934 | Los Angeles..... | 10,146 | 8,687 | 6.81 | .. | ... | .. |
| 1934 | Milwaukee ..... | 4,572 | 3,521 | 5.75 | .. | ... | .. |
| 1934 | New Orleans..... | 1,973 | 1,546 | 3.27 | 41 | ... | .. |
| 1933 | New York..... | 41,799 | 26,298 | 3.58 | 49 | 7.0 | 1.2 |
| 1933 | Pittsburgh ..... | 3,617 | 2,816 | 4.02 | 17 | ... | .. |
| 1934 | Portland, Ore..... | 3,310 | 3,114 | 9.79 | .. | ... | .. |
| 1934 | Seattle ..... | 3,670 | 2,932 | 7.42 | .. | ... | .. |
| 1934 | Washington ..... | 7,646 | 3,658 | 7.38 | .. | ... | .. |
| 1934 | Montreal ..... | 5,460 | 3,439 | 2.85 | 35 | ... | 2.3 |
| Average (North American cities)..... | | | | 6.16 | 31 | 5.7 | 1.5 |

*Includes 50% or more rescue calls.
†Includes 40% to 60% chimney fires.

and between $0.17 and $1.70 in a group of 14 American cities. The average loss per $1000 of property value is $0.853 for foreign cities, and $0.758 for American cities.

Five American cities report 27 to 76 per cent of their fire losses as resulting from only 0.2 or 0.3 per cent of all fires. Five foreign cities show 50 per cent or more of their total fire losses resulting from 0.5 to 2.0 per cent of all fires. Five American cities show losses from fires of unknown origin ranging between 35 per cent and 64 per cent, and averaging 51 per cent of the total

**Table III. Fire Department Personnel, Stations, and Apparatus.**

| City | Total Personnel | Total Fire Stations | Fire Fighting Units — Total in Service | Fire Fighting Units — Per 100,000 Population | Classification of Fire Apparatus — Salvage Units | Fire Boats | Pumping Engines | Ladder Trucks | Hose Wagons and Tenders | Booster Wagons with or without Escapes | Squad, Salvage and Other Special Service |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amsterdam .... | 382 | 11 | 20 | 2.5 | .. | 2 | 13 | 6 | .. | .. | 5 |
| Berlin ..... | 1,992 | 37 | 86 | 2.0 | .. | 4 | .. | .. | .. | .. | .. |
| Birmingham ... | 278 | 18 | 32 | 3.1 | .. | .. | 23 | 3 | .. | 11 | 1 |
| Bombay ..... | 281 | 10 | 14 | 1.2 | .. | .. | 11 | 2 | .. | 2 | 1 |
| Bremen ..... | 278 | 6 | 14 | 4.3 | .. | 2 | .. | .. | .. | .. | .. |
| Brussels ..... | .... | 8 | 13 | 1.9 | .. | .. | 6 | 4 | 5 | .. | .. |
| Cologne ..... | 304 | 8 | 15 | 2.0 | .. | 1 | 10 | 6 | .. | .. | .. |
| Copenhagen ... | 408 | 7 | 21 | 3.2 | .. | .. | 8 | 9 | 8 | .. | 1 |
| Dresden ..... | 311 | 5 | 15 | 2.3 | .. | 1 | 11 | 7 | 3 | .. | 7 |
| Düsseldorf .... | 227 | 5 | 13 | 2.7 | .. | 1 | 10 | 5 | 3 | .. | 4 |
| Glasgow ..... | 235 | 10 | 23 | 2.0 | .. | .. | 25 | 3 | .. | .. | 1 |
| Hamburg ..... | 675 | 13 | 37 | 3.3 | .. | 3 | 14 | 10 | 10 | 2 | 7 |
| Leipzig ..... | 306 | 5 | 14 | 2.0 | .. | .. | 9 | 6 | .. | .. | 2 |
| Liverpool ..... | 289 | 8 | 20 | 2.4 | .. | .. | 15 | 3 | 6 | .. | .. |
| London ..... | 2,105 | 62 | 153 | 3.5 | .. | 4 | 87 | 13 | 3 | 74 | 3 |
| Lyons ..... | 146 | 3 | 8 | 1.4 | 2 | .. | 5 | 2 | .. | .. | 5 |
| Milan ..... | 323 | 6 | 20 | 1.9 | .. | 1 | 13 | 2 | .. | 14 | 2 |
| Munich ..... | 266 | 5 | 15 | 2.0 | .. | .. | 9 | 7 | .. | .. | 3 |
| Oslo ..... | 218 | 6 | 17 | 6.5 | .. | 2 | 3 | 6 | 8 | .. | 2 |
| Paris ..... | 1,678 | 24 | 79 | 2.7 | 6 | .. | 40 | 27 | 4 | 28 | 20 |
| Shanghai ..... | 799 | 11 | 37 | 2.2 | .. | 2 | 15 | 4 | 1 | 21 | 2 |
| Stockholm ..... | 277 | 6 | 17 | 3.3 | .. | 2 | 11 | 7 | 1 | .. | 1 |
| Stuttgart ..... | 146 | 3 | 8 | 2.0 | .. | .. | 4 | 4 | 1 | .. | 1 |
| Sydney ..... | 608 | 42 | 49 | 3.8 | 2 | .. | 50 | 5 | 2 | .. | 2 |
| Vienna ..... | 1,019 | 31 | 94 | 5.0 | .. | .. | 43 | 13 | 16 | 43 | 28 |
| Average (Foreign cities)..... | | | | 2.8 | | | | | | | |
| Boston ..... | 1,728 | 68 | 87 | 10.8 | 6 | 3 | 61 | 43 | 56 | .. | 9 |
| Chicago ..... | 2,905 | 148 | 194 | 5.6 | 9 | 3 | 146 | 59 | 7 | .. | 21 |
| Columbus, O.... | 337 | 19 | 27 | 9.0 | .. | .. | 20 | 9 | 14 | .. | 4 |
| Denver ..... | 389 | 21 | 31 | 10.3 | .. | .. | 17 | 11 | 10 | .. | 3 |
| Detroit ..... | 2,045 | 69 | 97 | 7.0 | 4 | 2 | 67 | 35 | 11 | .. | 5 |
| Los Angeles.... | 1,748 | 76 | 99 | 7.7 | 4 | 3 | 81 | 24 | 45 | 1 | 49 |
| Milwaukee .... | 816 | 37 | 54 | 8.8 | 3 | 3 | 34 | 15 | 4 | .. | 4 |
| New Orleans.... | 712 | 41 | 54 | 11.4 | 3 | .. | 46 | 12 | 1 | .. | 5 |
| New York..... | 7,321 | 284 | 365 | 5.0 | 24 | 11 | 283 | 160 | 126 | .. | 32 |
| Pittsburgh ..... | 920 | 54 | 76 | 10.8 | .. | .. | 40 | 20 | 45 | .. | 1 |
| Portland, Ore... | 516 | 39 | 48 | 15.0 | 1 | 3 | 33 | 8 | 16 | .. | 3 |
| Seattle ..... | 656 | 34 | 46 | 11.8 | .. | 3 | 37 | 14 | 5 | .. | 3 |
| Washington .... | 866 | 38 | 46 | 9.3 | .. | 1 | 38 | 17 | 18 | .. | 5 |
| Montreal ..... | 902 | 45 | 92 | 7.8 | 7 | 2 | 16 | 31 | 31 | .. | 15 |
| Average (North American cities). | | | | 9.3 | | | | | | | |

losses, suggesting that incendiary fires stimulated by over-insurance and freedom from personal liability of the citizens for fire may be more widespread than the records indicate.

The ratio between the actual number of fires in American and foreign cities is 6 to 1, as shown in Table II. The effect of this upon the requirements for public fire protection is intensified by prevailing structural conditions favorable to the rapid spread of fire in American cities. Conflagrations which have occurred in American cities are traceable in most cases to widespread frame construction and lack of fire retardant roof coverings. The average ratio of fires extinguished by means of hose lines to the total number of fires is the same in American and foreign cities (Table II), proving that the six times more fires in American cities also means that there are six times the number of serious fires in American cities as in foreign cities. This condition indicates that a six times greater maximum probable operating load per day should be counted upon by American fire departments, with a corresponding greater probability of simultaneous fires. This calls for a larger fire force per unit of population in American cities as compared with foreign cities, but, as seen from Table III, the ratio of fire fighting units in service in American cities is a little over 3 to 1, as against a 6 to 1 volume of service required. Included in total alarms shown in Table II are calls for special services (resuscitation, accidents, etc.), which constitute as much as 50 per cent of the total number of alarms in German cities, for example. The majority of those are attended by special equipment, not included under fire fighting units, and involve the services of relatively few men, as compared with calls for fire.

Much attention has been devoted in the past decade to fire department training, including systems to provide technical and professional instruction for the fire department personnel. A system of prerequisite technical training and probationary work for the officers of most foreign fire departments is matched by a system of competitive promotional examinations for all ranks in American fire departments. Aside from routine drills and instruction for probationary firemen, efforts are being made in many cities, both in America and abroad, to give theoretical class instruction in fire fighting and its various ramifications to the entire personnel. Professional colleges conducted by fire departments for their members, as developed in New York and Los Angeles and other cities, have brought very gratifying results in improvement in the general efficiency.

As seen from Table IV, fire prevention inspections and enforcement of city ordinances appear to be greater in scope in American cities than in most foreign cities, but the latter do not generally furnish complete inspection records. Examination and approval of building and installation plans and frequent inspections and details to places of public assembly constitute the major activities of foreign fire departments in the field of fire prevention, in so far as

## Table IV. Fire Prevention Work by Fire Departments.

| Year of Report | City | Total Inspections Made | Violations Corrected |
|---|---|---|---|
| | **Foreign Cities** | | |
| 1933 | Amsterdam | 4,377 | .... |
| 1934 | Birmingham | 7,357 | 742 |
| 1933 | Bombay | 766 | .... |
| 1933 | Calcutta | 6,014 | .... |
| 1934 | Hamburg | .... | 1,329 |
| 1933 | Leipzig | 444 | .... |
| 1933 | Liverpool | 2,004 | .... |
| 1933 | London | 22,375 | .... |
| 1933 | Lyons | 629 | .... |
| 1934 | Milan | 3,800 | .... |
| 1933 | Munich | 39,669 | 2,338 |
| 1933 | Oslo | 3,364 | .... |
| 1934 | Shanghai | 18,078 | 1,324 |
| 1929 | Vienna | 36,718 | 16,353 |
| | **U. S. Cities** | | |
| 1934 | Boston | 103,865 | 10,474 |
| 1930 | Chicago | 29,340 | .... |
| 1934 | Denver | 12,955 | 837 |
| 1933 | Los Angeles | 348,510 | 33,986 |
| 1934 | Milwaukee | 442,260 | 7,602 |
| 1934 | New Orleans | 35,932 | 1,863 |
| 1932 | New York | 200,394 | 39,476 |
| 1933 | Pittsburgh | 21,830 | 2,133 |
| 1934 | Portland, Ore. | 46,354 | 30,464 |
| 1934 | Seattle | 32,669 | .... |

Note: Many foreign fire departments report making periodic inspections of hazardo premises, public buildings and places of public assembly, but do not state the number inspections made.

Above total inspections do not include theatre details of firemen to performances.

can be learned from their annual reports. The relation between a greater nun ber of fires in American cities and a smaller number of fires in foreign citi cannot be directly traced to any specific fire prevention activities. The great number of fires in American cities is probably chargeable mainly to less ge eral fire-resistive construction, to over-insurance, to deficiency in prosecutio of negligence and to lack of general application of the principle of person liability for fire; possibly also to a faster tempo of activity resulting in i creased carelessness.

In the group of large American cities under consideration the loss redu tion over the past 5 years has been from an average of $2.81 to $1.31 p capita. Extensive fire prevention activities and marked improvement in fi department training and methods have undoubtedly contributed to the redu tion in fire losses. Those efforts accomplished a 53 per cent reduction in th amount of loss, but only a 10 per cent reduction in the total number of fire proving that other important factors, some of which are mentioned abov affect the frequency of fires. That group of factors cannot be controlled solel by fire department efficiency, but by enactment of enforceable and adequa laws which will show their effect in time.

Loss reductions amounting to 50 per cent have been accomplished during the past five years by many foreign departments also. It is interesting to note that small loss figures for German cities are coincident with the fact that frame construction is practically non-existent in German cities, negligence resulting in fire is penalized, over-insurance is abated through the operation of an enforced insurance system for all buildings, and fire department training is of a very high quality.

In conclusion, the statement seems to be in order that the magnitude of the fire problem in American cities fully justifies much larger fire departments than are considered adequate for foreign cities of equal population. At the present time, in proportion to the amount of service required, American fire departments average 50 per cent weaker than those of foreign cities; a fact which becomes of serious importance at times of seasonal fire epidemics when fire departments operate under conditions of peak load.

# Observations on Wiring Practices Abroad.

By M. G. Lloyd,
(Member N.F.P.A.).

Attendance at international conferences in Europe in 1935 afforded the writer some opportunity to observe practices in the wiring of buildings, but not time for a thorough investigation such as would have been of interest.

The advocacy of the bare-neutral system for the interior wiring of buildings in the United States made it of especial interest to investigate the use of that system in England, where it is not a new proposal, but has been in use for many years. Its use has been very restricted, but I was fortunate in finding one installation which I could inspect.

Since in this system the neutral wire is not insulated and is subject to contact with grounded objects throughout its run, the conditions for its use in England are not very favorable. The Electricity Supply Regulations (1934) state in paragraph 4 (a):

> The connection with earth shall be made at one point only in each distinct system, unless connection with earth at more than one point is for the time being approved by the Electricity Commissioners with the concurrence of the Postmaster-General and is made in accordance with the conditions, if any, of that approval, and the insulation of each such system shall be efficiently maintained at all other parts.

Formerly there were no approvals for local grounding, so that the wiring had to be insulated from the supply circuit by the use of a transformer. More recently I am informed that such approvals have been issued in certain instances.

Earthed concentric wiring is recognized in the Regulations for the Electrical Equipment of Buildings, issued by the Institution of Electrical Engi-

neers. Rule 412 (a) of the 1934 edition states:

> Earthed concentric wiring shall only be used where:—
> (a) It is connected to the secondary side of a transformer or converter and is so arranged as to be electrically insulated from the public supply system; or
> (b) It has been approved by the Electricity Commissioners for connection to a particular supply system; or,
> (c) The supply is obtained from a private generating plant.

For isolated plants, the use of concentric wiring is not restricted to alternating current, and I am informed it has been used in a number of such installations.

### Bare Neutral Wiring Installation.

The installation which I visited through the courtesy of Mr. Hird of the Fixed Price Light Company was in a London tenement house on the south side of the Thames River (Waterloo). The conductor used is known as "Stannos" wire and consists of a rubber-insulated, stranded copper conductor surrounded by a tinned copper sheath. This sheath is of sufficient thickness to provide a greater cross-section than the inner conductor, so that the drop of voltage on the neutral conductor is lower than is customary in the ordinary 2-wire insulated system. The sheath is water-tight and is rigid enough to be mechanically strong and makes a very neat appearance when run as exposed wire. It is, however, semi-flexible, so that it can be bent around corners with a liberal radius.

Special fittings have been devised for making joints and taps, and in these fittings the grounded outer conductor is clamped and not soldered to the fittings. Care is taken in running this conductor to keep it out of contact with gas piping. Every attempt has been made to make the installation as inexpensive as possible, including the use of hardwood switch bases. Pendent cords take the place of ceiling or wall fixtures, to a large extent. Special lampholders and lamp bases have been utilized, so that the different sizes of lamps are not interchangeable. This is done for the reason that lamps are supplied by the company above mentioned, with free renewals, and current is also supplied by them at a fixed price per week on a flat-rate basis, and no initial charge is made for the wiring of the building. Such a flat rate basis of supply eliminates the need for installation and reading of meters in the premises of the individual tenants, and there is but one meter to measure the current supplying the entire block of tenements. This meter is the basis for reimbursement of the utility company by the contracting company which deals directly with the tenant.

Supply for the earthed concentric system is usually through a transformer which steps the distribution voltage of 230 volts down to 115 volts. In other cases permission has been obtained to connect the wiring system directly to the supply mains.

Inquiry among electrical engineers gave me the impression that this method of wiring was not regarded as first-class, had not been widely used,

and was not considered for important buildings. The Chief Electrical Inspector for Factories, Mr. H. W. Swann, of the Home Office, stated that he did not know of any installation of the earthed concentric system of wiring in factories or other industrial plants coming under his jurisdiction. Nevertheless, installations similar to the one inspected were said to exist in other districts of London, at Gillingham and other places, and throughout the entire area of a few local supply systems. As noted below, however, an earth connection of not more than 1 ohm is an essential unless other precautionary measures are applied.

### The Leakage-Trip Coil

A device whose use is increasing in England deserves special mention here. It is designated as "The Leakage-Trip Coil" and its use is specified in the following paragraphs from the Wiring Regulations. Under "Control and Distribution of the Supply," Rule 116 states:

> Where the normal working current in an outgoing circuit from a distribution fuse-board or switchboard or from the main switchgear exceeds 100 amperes, unless it can be ensured that the total resistance of the earth continuity path at all times is so low as to permit, in the event of a fault to earth on an outer or phase conductor, or on the non-earthed conductor of such circuit, sufficient overload current to flow to operate the circuit-breakers or cut-outs protecting the circuit, there shall be fitted an automatic leakage-trip device whereby such circuit or the whole installation shall be disconnected from the supply whenever the leakage to earth attains a prescribed value not greater than 100 amperes (see also Regulation 1005).

In the section on "Earthing," Rule 1005 (C) states :

> Where it is economically impracticable to obtain an earth having a resistance of not more than 1 ohm, earthing shall be supplemented by an earth-leakage trip so adjusted that it will operate at not more than 30 milliamperes. In this circumstance the automatic leakage-trip device specified in Rule 116 is not required.

Rule 1002, which deals with Bathrooms, contains the following in a fine-print note:

> If portable appliances are not of the "all-insulated" type it is recommended that the final sub-circuits be protected by automatic leakage-trip devices set to operate on a leakage current not exceeding 30 milliamperes.

Since lighting circuits in England are usually operated at 230 volts, and both fixed and portable appliances are of the same voltage class, the need for protective devices to prevent shock in case of insulation failure is much greater than in the United States. The need for this protection has, consequently, been felt more keenly and has led to the introduction of the leakage-trip coil and to the requirements quoted above in the wiring rules.

It is common to incorporate a leakage-trip coil in the same device which furnishes overload protection so that this device will open the circuit in case of either overload or insulation failure, even though the latter is not of a nature to produce a short-circuit or a path to ground that would pass enough current to trip an overload circuit-breaker.

In Germany I found that this same leakage-trip device was recognized in the rules. Its use appears to have originated with the Rheinisch-Westfaelischen Elektricitaets-Werke Aktien Gesellschaft, which has its headquarters at Wesel. The Director, Herr Heinisch, and his staff, extended every courtesy to me when I took the opportunity to visit them and see actual installations of such a device.

The distribution of this company is largely in rural territory and is at 380 volts, 3-phase, 4-wire, giving 220 volts on one phase for lighting. The German rules call for the leakage-trip device under conditions where the voltage to ground can exceed 65 volts on any exposed metal, but this particular company considers 42 volts the limit for safety, and the tripping devices are set to operate whenever the voltage on exposed parts exceeds this value owing to leakage from a phase wire.

Installations of this type were demonstrated to me in a farmhouse and barn and also in a creamery where there were a number of 3-phase motors. Tests made in my presence showed that the tripping occurred definitely at a value of 42 volts when, by the use of a resistor, the voltage was gradually raised to this value. The device used in these cases had trips for both leakage current and overload, the former depending upon electromagnetic action, whereas the latter was thermally actuated. The factory price for such a device in small sizes was stated to be not over $7.00. Its use had been largely dictated by casualties to farm animals, although it offers the more important, if perhaps less often needed, protection to human beings also.

The only requirement for similar protection in the National Electrical Code is found in connection with the use of cranes having bare contact conductors in the presence of combustible fibrous materials (see Article 32, Hazardous Locations, paragraphs 3205-o and 3206-n).

# Fire Department Records.

By Percy Bugbee.

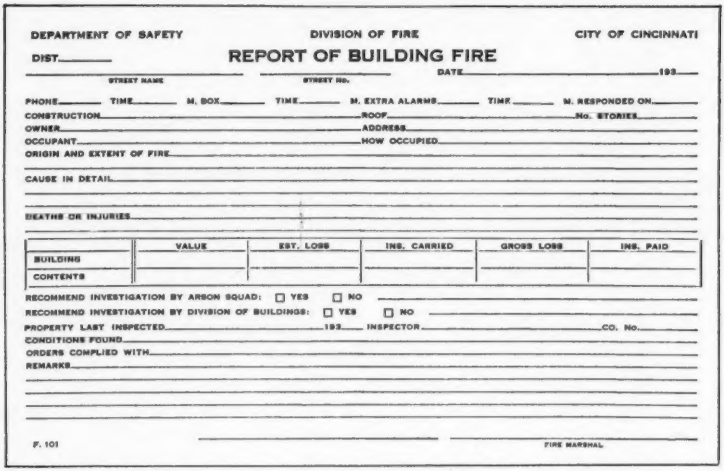
There are nearly as many fire department record systems in use today as there are fire departments, with a bewildering array of record forms of all shapes and sizes, for all sorts of purposes. Record forms used in fire departments in some fifty of the larger cities of the United States and Canada, assembled by the field engineers of the National Fire Protection Association, show no uniformity in records or procedure. Without such uniformity comparisons between the fire department results in different cities must be more or less inaccurate. There is a real need for greater uniformity in record and reporting procedures.

The average fire department record system has developed in a haphazard manner over a period of years. From time to time a need arises for specific information and records devised on the spur of the moment to provide such information. This has led to a heterogeneous collection of record forms often burdensome to keep and many times with useless and unnecessary records to be filled out often lacking in vital information.

It is a practical impossibility to design a perfect system of fire department records applicable to cities of all sizes and to fire departments of all kinds. The organization plan of fire departments is not alike in any two cities and the structure of the city government itself has a definite influence on the kind of records that are kept. Certain fundamental information, however, is desirable in any fire record system. Such basic records are important to the effective administration of fire departments and the efficiency of the service rendered to the public.

During recent years there has been an increasing interest in records on the part of fire department officers. The increased fire prevention activity in fire departments has led to the development of records of inspections by firemen and by fire prevention bureaus. The establishment of arson squads has shown the importance of proper records in the detection and prosecution of incendiarism.

The pressure upon fire departments, like other city departments, for economy during recent years has had a stimulating effect on city officials to render a more accurate account of the department's activity to justify its expenditures and to support requests for appropriations. It is only through an accurate system for reporting fires and for recording fire department activities that fire department operation can be intelligently appraised. This does not mean, however, that an unduly elaborate and complicated record system is required.



DEPARTMENT OF SAFETY — DIVISION OF FIRE — CITY OF CINCINNATI

DIST._____

REPORT OF BUILDING FIRE

_____ (STREET NAME) _____ (STREET No.) DATE_____ 193__

PHONE_____ TIME_____ M. BOX_____ TIME_____ M. EXTRA ALARMS_____ TIME_____ M. RESPONDED ON_____

CONSTRUCTION_____ ROOF_____ No. STORIES_____

OWNER_____ ADDRESS_____

OCCUPANT_____ HOW OCCUPIED_____

ORIGIN AND EXTENT OF FIRE_____

CAUSE IN DETAIL_____

DEATHS OR INJURIES_____

| | VALUE | EST. LOSS | INS. CARRIED | GROSS LOSS | INS. PAID |
|---|---|---|---|---|---|
| BUILDING | | | | | |
| CONTENTS | | | | | |

RECOMMEND INVESTIGATION BY ARSON SQUAD: ☐ YES ☐ NO _____

RECOMMEND INVESTIGATION BY DIVISION OF BUILDINGS: ☐ YES ☐ NO _____

PROPERTY LAST INSPECTED_____ 193__ INSPECTOR_____ CO. No._____

CONDITIONS FOUND_____

ORDERS COMPLIED WITH_____

REMARKS_____

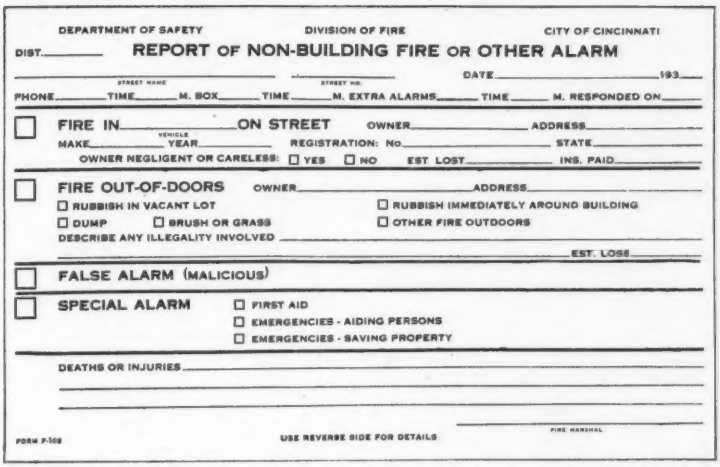
F. 101 — FIRE MARSHAL

**Fig. 1. Simple Form for Reporting Fires in Buildings Used in Cincinnati.**

It is hardly necessary to discuss the desirability of good record systems in fire departments. An adequate record system gives the fire department the basis for its reports to city officials and to the public. It shows the progress being made in controlling and preventing fires; it provides a basis for comparison of the city's fire record with other cities; indicates where fires are occurring and what is causing the fires and losses; provides information for special inspection campaigns in various districts of the city, covering various special fire hazards; discloses the trend of the fire loss; indicates the need for certain laws and ordinances and indicates in general the entire progress and efficiency of the department.

Fundamental records which are of vital importance in most fire departments are discussed in the following paragraphs. Additional records of various types which cannot be described in the limits of this article, have also been found useful in many fire departments.

1. The Fire and Alarm Report. Obviously the most fundamental fire department record is the report made out by the officer in charge for each fire or run made by his company or department. Simple forms for reporting fire department runs are indicated by Figures 1 and 2. It is desirable to report building fires and other fires or alarms separately, especially where there is a large number of runs each year. The amount of details reported on fires can only best be determined by the facilities for reporting afforded by the individual department. The department whose men are well trained can furnish fire reports in vastly better detail than those departments with little training. A complete



DEPARTMENT OF SAFETY — DIVISION OF FIRE — CITY OF CINCINNATI

DIST._____ REPORT OF NON-BUILDING FIRE OR OTHER ALARM

_____ (STREET NAME) _____ (STREET NO.) DATE _____ 193__

PHONE_____ TIME_____ M. BOX_____ TIME_____ M. EXTRA ALARMS_____ TIME_____ M. RESPONDED ON_____

☐ FIRE IN_____ (VEHICLE) ON STREET OWNER_____ ADDRESS_____

MAKE_____ YEAR_____ REGISTRATION: No._____ STATE_____

OWNER NEGLIGENT OR CARELESS: ☐ YES ☐ NO EST. LOST_____ INS. PAID_____

☐ FIRE OUT-OF-DOORS OWNER_____ ADDRESS_____

☐ RUBBISH IN VACANT LOT ☐ RUBBISH IMMEDIATELY AROUND BUILDING

☐ DUMP ☐ BRUSH OR GRASS ☐ OTHER FIRE OUTDOORS

DESCRIBE ANY ILLEGALITY INVOLVED _____

_____ EST. LOSS_____

☐ FALSE ALARM (MALICIOUS)

☐ SPECIAL ALARM ☐ FIRST AID

☐ EMERGENCIES - AIDING PERSONS

☐ EMERGENCIES - SAVING PROPERTY

DEATHS OR INJURIES _____

_____

_____

_____ (FIRE MARSHAL)

FORM P-108 USE REVERSE SIDE FOR DETAILS

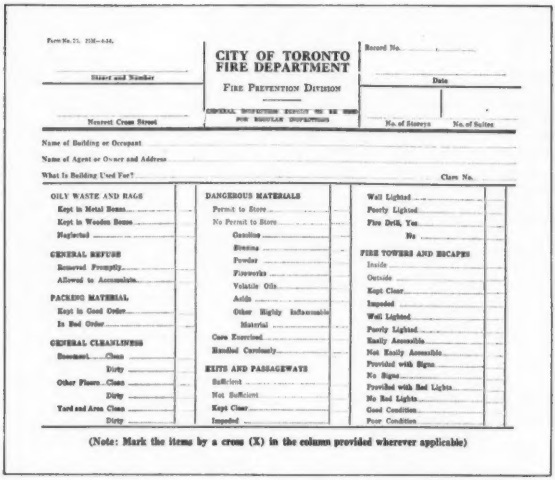
**Fig. 2. Simple Form for Report of Fires Other than Fires in Buildings Used in Cincinnati.**

fire report for a fire in a building will contain such information as the construction and contents of the building, the cause of the fire in detail, the complete operations of the fire department at the fire, complete data on the losses to building and contents, details on the private fire protection facilities in the building and how they were used, and an accurate account of the progress of the fire from the time the fire department arrived until the fire was out.

2. Report of Run Made. In the larger departments where several companies may respond to a fire a desirable supplementary form to the fire report form is the report of the run made by each company. These reports are made out by the company officer and serve as a check upon the fire report made by the officer in charge and upon the operations of the individual companies. The reports of company runs should be confined to showing just what the particular company did, what equipment it used, and how it used it. Such reports of company runs are especially useful in studying large fires and for the drillmaster in instructing the men as to the best practices in the technique of fire fighting.

3. Company Diary and Company Journal. An essential record for any fire department is a company diary in which is recorded whatever takes place at the company quarters. This may be simply a blank notebook in which is recorded in chronological order by entering times or by a time stamp the events of the day. The company diary is kept by the man on watch.

In addition to the diary each company should have a journal in which may be recorded the permanent record of company activities. Usually such



Form No. 75. 25M—4-34.

CITY OF TORONTO
FIRE DEPARTMENT
FIRE PREVENTION DIVISION

GENERAL INSPECTIONS SHOULD BE MADE FOR REGULAR INSPECTIONS

Record No. .....

Date .....

Street and Number

Nearest Cross Street

No. of Storeys | No. of Suites

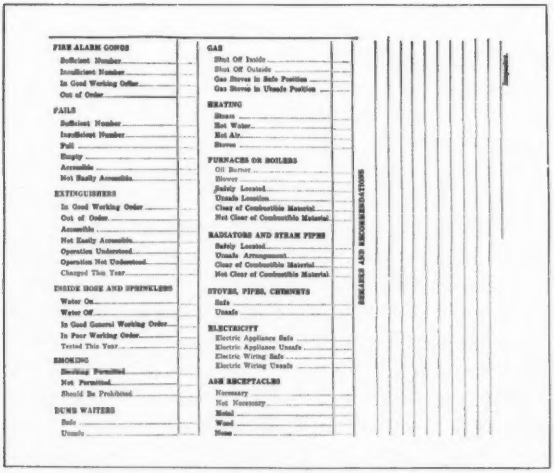
Name of Building or Occupant

Name of Agent or Owner and Address

What Is Building Used For? Class No.

| OILY WASTE AND RAGS | DANGEROUS MATERIALS | |
|---|---|---|
| Kept in Metal Boxes | Permit to Store | Well Lighted |
| Kept in Wooden Boxes | No Permit to Store | Poorly Lighted |
| Neglected | Gasoline | Fire Drill, Yes |
| GENERAL REFUSE | Benzine | No |
| Removed Promptly | Powder | FIRE TOWERS AND ESCAPES |
| Allowed to Accumulate | Fireworks | Inside |
| PACKING MATERIAL | Volatile Oils | Outside |
| Kept in Good Order | Acids | Kept Clear |
| In Bad Order | Other Highly Inflammable Material | Impeded |
| GENERAL CLEANLINESS | Care Exercised | Well Lighted |
| Basement ...Clean | Handled Carelessly | Poorly Lighted |
| Dirty | EXITS AND PASSAGEWAYS | Easily Accessible |
| Other Floors ...Clean | Sufficient | Not Easily Accessible |
| Dirty | Not Sufficient | Provided with Signs |
| Yard and Area Clean | Kept Clear | No Signs |
| Dirty | Impeded | Provided with Red Lights |
| | | No Red Lights |
| | | Good Condition |
| | | Poor Condition |

(Note: Mark the items by a cross (X) in the column provided wherever applicable)



| FIRE ALARM GONGS | GAS | |
|---|---|---|
| Sufficient Number | Shut Off Inside | |
| Insufficient Number | Shut Off Outside | |
| In Good Working Order | Gas Stoves in Safe Position | |
| Out of Order | Gas Stoves in Unsafe Position | |
| PAILS | HEATING | |
| Sufficient Number | Steam | |
| Insufficient Number | Hot Water | |
| Full | Hot Air | |
| Empty | Stoves | |
| Accessible | FURNACES OR BOILERS | |
| Not Easily Accessible | Oil Burner | |
| EXTINGUISHERS | Blower | |
| In Good Working Order | Safely Located | |
| Out of Order | Unsafe Location | |
| Accessible | Clear of Combustible Material | |
| Not Easily Accessible | Not Clear of Combustible Material | |
| Operation Understood | RADIATORS AND STEAM PIPES | |
| Operation Not Understood | Safely Located | |
| Charged This Year | Unsafe Arrangement | |
| INSIDE HOSE AND SPRINKLERS | Clear of Combustible Material | |
| Water On | Not Clear of Combustible Material | |
| Water Off | STOVES, PIPES, CHIMNEYS | |
| In Good General Working Order | Safe | |
| In Poor Working Order | Unsafe | |
| Tested This Year | ELECTRICITY | |
| SMOKING | Electric Appliance Safe | |
| Smoking Permitted | Electric Appliance Unsafe | |
| Not Permitted | Electric Wiring Safe | |
| Should Be Prohibited | Electric Wiring Unsafe | |
| DUMB WAITERS | ASH RECEPTACLES | |
| Safe | Necessary | |
| Unsafe | Not Necessary | |
| | Metal | |
| | Wood | |
| | None | |

REMARKS AND RECOMMENDATIONS

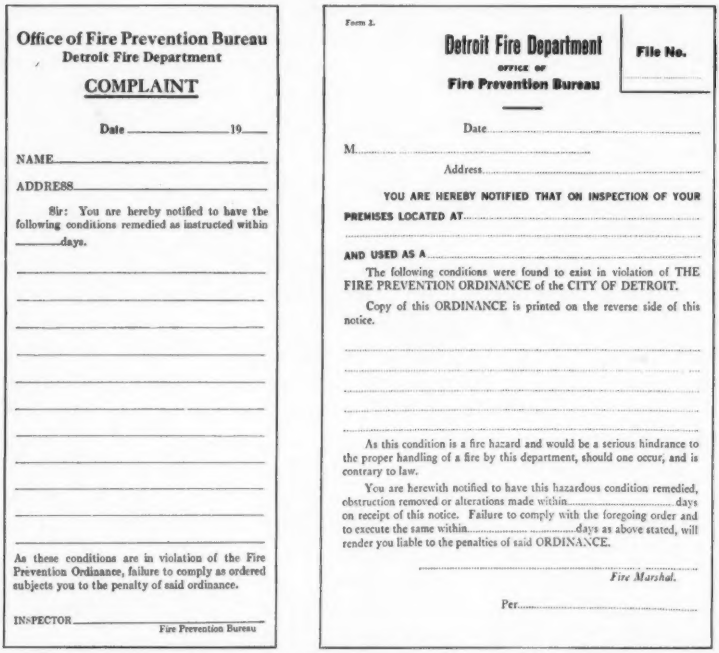
Fig. 3. Form used by inspectors of the Fire Prevention Bureau in Toronto.

journals are large record books with suitable rulings to cover such items as the roster of the company, record of sick, injured and leaves, record of fire fighting equipment, new equipment received, repairs to apparatus, working time at fires, gasoline supply, other supplies, charging of batteries, hose record, drill school evolutions and ratings, inspections of buildings in the district, hydrant inspections, special details to members. The company journal forms an important method for checking up on men and equipment and contains vital information for the company officer for detailing his men and for checking supplies and equipment.

4. Daily Report of the Fire Alarm Office. In all cities where there is a fire alarm headquarters the fire alarm office should send a daily report of its activities to the chief. This report should contain a record of each alarm received, the location of the fire and the kind of alarm (building fire, brush or grass, automobile, etc.). The report should also include information on any box or line trouble. Such a record is a valuable check against the fire reports that come in from the various companies.

5. Headquarters Journal. A record that is perhaps more widely used by all departments than any other is the headquarters journal. The journal is a permanent master record of each alarm entered chronologically. The ordinary fire department journal is a substantially bound book with pages 19 x 10½ inches. Standard journals are furnished to fire departments by the National Board of Fire Underwriters, 85 John Street, New York, at the nominal cost of one dollar per copy. The data to be entered in the journal respecting each fire are the following: date of fire, time of day, record of alarm (whether box alarm or telephone alarm), location of fire, names of parties sustaining loss (including names of owners of building and occupants) construction of building, number of stories, occupancy of building, fires other than in buildings (such as grass or dump fires), record showing the extent of the fire (whether confined to one floor, one building, or extending to adjoining buildings), the cause of the fire, how the fire was extinguished, the apparatus and equipment used, the value and insurance loss both insured and uninsured, both on the building and contents separately, and the totals for both. Entries in the journal should be made by the fire department record clerk at the end of each month from his fire report cards. Summaries of the journal data form the basis of monthly and annual reports which are discussed later. The chronological record in the journal, supplemented by fire report cards filed by street address and by fire causes, forms an excellent cross-reference of fires.

6. Inspection Form. A record of all inspections of property for fire hazards made by the individual firemen and fire officers in their districts and by the inspectors in the fire prevention bureau is fundamental for good inspection work. Figure 3 shows a good inspection form utilized by the fire prevention bureau in Toronto. A more simple type of inspection form may be best



Office of Fire Prevention Bureau
Detroit Fire Department

COMPLAINT

Date _____ 19____

NAME _____

ADDRESS _____

Sir: You are hereby notified to have the following conditions remedied as instructed within _____ days.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

As these conditions are in violation of the Fire Prevention Ordinance, failure to comply as ordered subjects you to the penalty of said ordinance.

INSPECTOR _____
Fire Prevention Bureau

Form 2.

Detroit Fire Department
OFFICE OF
Fire Prevention Bureau

File No. _____

Date _____

M. _____

Address _____

YOU ARE HEREBY NOTIFIED THAT ON INSPECTION OF YOUR PREMISES LOCATED AT _____

_____

AND USED AS A _____

The following conditions were found to exist in violation of THE FIRE PREVENTION ORDINANCE of the CITY OF DETROIT.

Copy of this ORDINANCE is printed on the reverse side of this notice.

_____

_____

_____

_____

_____

As this condition is a fire hazard and would be a serious hindrance to the proper handling of a fire by this department, should one occur, and is contrary to law.

You are herewith notified to have this hazardous condition remedied, obstruction removed or alterations made within _____ days on receipt of this notice. Failure to comply with the foregoing order and to execute the same within _____ days as above stated, will render you liable to the penalties of said ORDINANCE.

_____
*Fire Marshal.*

Per _____

**Fig. 4. Forms used to order the abatement of a fire hazard by the Detroit Fire Prevention Bureau. The one at the left is used where the order will probably be complied with without further action. The other is a formal order which may be followed by a court summons.**

for the inspections by the regular firemen. A good inspection form provides a check list of hazards so that the inspector cannot fail to make a proper inspection if he is conscientious. It is desirable to have a form filled out for every inspection, not only for the record but for the good psychological effect upon the occupant of the building. Inspection records are usually kept in duplicate, the originals being filed by street address at the company headquarters or in the fire prevention bureau, and the duplicate being kept by the inspector. Good inspection records are vital to planning inspection work and in following up hazards. Inspection records indicating hazards to be corrected are kept in a separate file until the hazard has been corrected.

7. NOTICE OF VIOLATIONS. The fire department inspector must have a simple form to fill out and to leave with the property owner when he finds a hazard. The original form giving a brief explanation of the hazard and a suggested remedy is left with the person responsible and the duplicate is retained by the inspector for further follow-up. (Figure 4.)

8. LIABILITY NOTICE. A liability notice which the chief issues to the property owner when ordinary inspection procedure has failed, is another essential form. A good form of such notice is illustrated in Figure 4. It is desirable to have the city ordinance giving the fire department the authority for issuing orders printed on the back of this form.

9. COMPANY BUILDING INSPECTION RECORD. A record which while it cannot be classified as essential is nevertheless very desirable, is a card which may be maintained on file in each fire company providing data on the individual buildings in the company district. This record card should be so designed as to provide the fire and inspection history of the building and if possible a sketch showing the plan of the building, the arrangement of exits, location of sprinkler valves, location of hydrants, location of special fire hazards, etc. The fire companies that have such a file at their disposal are much better prepared to handle any possible fires in their district than companies without such a record. This sort of record is a very valuable adjunct to the training school in discussing fires in various types of occupancies. It is also a desirable record in showing the relationship between inspections, hazards and fires.

10. FIRE INVESTIGATION FORM. The more progressive fire departments have come to realize that a systematic investigation of all fires to determine the cause of the fire, especially in cases where the origin of the fire appears suspicious, is a very valuable record. In the larger departments men may be detailed to devote their full time to fire investigation work and more elaborate record forms may then be utilized. A good fire investigation form is a questionnaire or check list of items that may help uncover clues as to why, how and by whom the fire was caused. Every arson squad keeps such forms for its own purposes. An adequate investigation of fires means an adequate control of the incendiary problem. A good fire investigation form will record such data as owner and occupants of the property, hazardous material found on the property, witnesses located at the scene of the fire, financial status of the property owner, etc.

11. PERSONNEL RECORD. A well-designed report form covering the personal history of each member of the fire department is a very vital record. About 95% of the annual expenditures of fire departments go for personal services, and an accurate record of each man in the department is necessary for efficient operation. A good example of a form used for personnel recording is indicated in Figure 5. A record should be filed for every man in the department and an envelope containing miscellaneous papers concerning the man's record and progress should be kept with the record card.

12. CONSOLIDATED MONTHLY REPORT. It is desirable, particularly in the larger cities, to provide a consolidated monthly report which compares

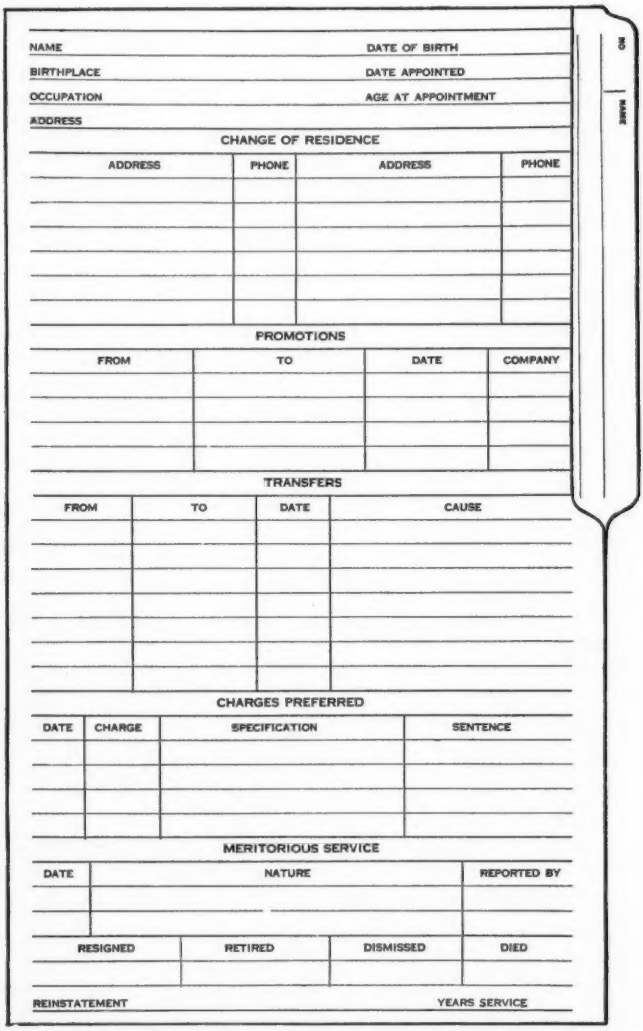

NO.
NAME
NAME
DATE OF BIRTH
BIRTHPLACE
DATE APPOINTED
OCCUPATION
AGE AT APPOINTMENT
ADDRESS
CHANGE OF RESIDENCE
ADDRESS
PHONE
ADDRESS
PHONE
PROMOTIONS
FROM
TO
DATE
COMPANY
TRANSFERS
FROM
TO
DATE
CAUSE
CHARGES PREFERRED
DATE
CHARGE
SPECIFICATION
SENTENCE
MERITORIOUS SERVICE
DATE
NATURE
REPORTED BY
RESIGNED
RETIRED
DISMISSED
DIED
REINSTATEMENT
YEARS SERVICE

**Fig. 5. Front of cardboard letter file used to record personnel data in Cleveland. There is a file for each man in the fire department.**

standard classifications of alarms, causes of fire, etc., from month to month. This report is made up from the daily reports. Such monthly reports present a ready and up-to-date picture of what is going on in the department. Monthly reports form a good basis for newspaper articles and are useful in noting trends. The data to be contained in the monthly report will vary with the degree of completeness of the department record system.

OTHER MISCELLANEOUS FORMS. There are many other useful forms employed by fire departments. Every department will find it desirable to have a record of equipment with a card for each piece of apparatus providing for data on its history. Similar records are kept for each fire alarm box and for supplies of fire hose. There should be records for reporting injuries to firemen and absences from the department. Complaint forms for recording complaints from the public are desirable. Requisitions for supplies and purchase orders should be in standard form. A very useful apparatus inspection form is indicated in Figure 6.

THE ANNUAL REPORT. Every fire department, large or small, should issue an annual report shortly after the end of each fiscal year. There are still a surprisingly large number of fire departments which do not issue an annual report. These departments are hurting themselves as they do not give the citizens of their community any opportunity to review the work that the department accomplishes during the year. The more complete the annual report is made, the better it is for the department and every man in it. A good annual report should contain an organization chart of the department, a narrative of the policies of the department, important changes during the year, and recommendations for succeeding years. A chart showing the number of fires compared with population, condensed financial statement of the department, a summary of the apparatus, equipment and manpower, and description of special department services rendered are desirable items to be included. In making up the annual report it is very desirable to aim for a standard, thoroughly explanatory classification of fires and alarms. Alarms should be recorded, showing the medium through which they are received, such as alarm box, telephone, auxiliary boxes, verbal alarms, etc. Fires should be classified, if possible, as residence building fires, other building fires, rubbish or dump fires, brush or grass fires, other outdoor fires, automobile fires and other vehicle fires. The record of causes of fires should show the causes for each class of fires just mentioned. The detail of fire causes listed will depend on the size of the city and the number of fires. The larger the number of fires, the more detailed the cause classification should be. False alarms should be recorded separately, needless or accidental alarms shown separately, and calls outside of the city shown. It is very desirable to classify fires by losses under $100, $100 to $1000, $1000 to $5000, $5000 to $15,000 and over $15,000. If the majority of fire departments issued an annual report and provided a classification of

fires and alarms on some such basis as described above, a much more valuable record for the basis of comparison between departments could be secured. A good annual report should be extremely helpful in securing adequate appropriations and building good will for the department.

## *Weekly Apparatus Inspection*

(Use separate sheet for each truck)

Engine No.....
Truck No.....

WEEK ENDING..... INSPECTION BY.....
Miles traveled.....

How much hose on truck? 2½".....ft. 1½".....ft. Chem.....ft.
When was hose last changed?.....
Suction hose.....ft. Condition.....
How many nozzles?.....sizes:..... tips.....
How many axes?..... What condition?.....
How many pikes?..... What condition?.....
How many covers?.....Repair.....Fold.....
How many masks?.....Kind.....Condition.....
How much rope?.....Rolled correctly?.....Condition.....
Inhalator.....Condition..... First Aid Kit.....Condition.....
Chemical or booster tank full?..... Date recharged.....
How much air in tires? R.F.....L.F.....R.R.....L.R.....Sp.....
How much gas in tank?.....gals. Battery condition.....
Is radiator full?.....Oil O.K.?..... Date changed.....
Brakes: R.F.....L.F..... R.R.....L.R.....
Lights: R.F.....L.F..... Tail..... Searchlight.....
Ignition wiring..... Spark plugs..... Fan belt.....
Transmission..... Differential.....

MINOR EQUIPMENT. Check for location and condition.

| | | | |
|---|---|---|---|
| Lanterns | Double Male | Spanners | Large Wire Cutters |
| Flashlights | Double Female | Belts | Small Wire Cutters |
| Crowbar | Siamese Conn. | Roof Cutter | Rubber Gloves |
| Cellar Pipe | Hose Kinker | Hand Saws | Jack |
| Cellar Nozzle | Deluge Set | Augers | Wire Brooms |
| Door Opener | Life Net | Squeegees | Sprinkler Wedges |
| Hose Jacket | Shovels | Brooms | (or tongs) |
| Hose Roller | Forks | Mops | Sprinkler Heads |
| Y Connection | Bale Hooks | Sawdust | Hydrant Wrenches |
| Gate Valves | Rope Tools | Roof Paper | Hatchets |

EXTINGUISHERS:

| | | | |
|---|---|---|---|
| Soda-Acid | Condition | Charged | |
| Carbon Tetrachloride | Condition | Charged | |
| Carbon Dioxide | Condition | Charged | |
| Foam | Condition | Charged | |
| Other type | Condition | Charged | |
| Foam generator | Condition | Powder | lbs. |

General condition of apparatus.....
Condition of Fire Station.....

SUGGESTIONS (Details of any defects noted above may be entered here and needed repairs indicated.)

.....
.....
.....
.....

**Fig. 6. A useful apparatus inspection form developed by the Fire Department Instructor's Conference sponsored by the Western Actuarial Bureau.**

# Electrical Thawing of Frozen Water Pipes.

Electrical methods for thawing frozen water pipes have been coming into increasing use during the past few years. These methods have certain obvious advantages over thawing by older methods, particularly in the case of underground pipes, but also entail certain hazards which may cause fires, personal injury or damage to the pipes unless the electrical thawing is carefully done by persons thoroughly familiar with this work.

In most communities electrical thawing is done only by the electric or water utilities, as the use of electrical equipment and the possibilities of damage to the water pipe make it inadvisable to have this method used by the general public. An exception is found in the case of thawing exposed pipes inside buildings where portable electric radiant heaters are often used, or in the case of small pipes electric heating pads may be wrapped around the pipes to furnish enough heat to thaw sections of pipes several feet in length. These home methods are obviously far preferable to the use of torches.

Electrical thawing finds its principal application in the case of underground pipes which can be warmed by electric current passing through them. This operation is performed by the electric and water utilities or other concerns specializing in this work in many communities and has generally proven successful. The cost is only a small fraction of that which would be involved in making an excavation necessary to perform the thawing by fire heat or by steam.

Electrical thawing depends upon passing a heavy current through the frozen pipe. As the heating effect depends upon the current and not upon the voltage, it is customary to use only a sufficient voltage to overcome the resistance in the pipe and produce the desired current flow. Voltages of about 55 are commonly used for this purpose.

Freezing in underground pipes most commonly occurs in the service pipe lines between street mains and buildings. The practice is to make an electrical connection to the pipe at the point it enters the house and another connection to a near-by street hydrant. In the absence of a hydrant, connection may be made to a water service pipe in some near-by house.

Street mains, owing to the circulation of water, are less subject to freezing than services, but the electrical method has been applied with good results to street mains, usually by making connections to two adjacent hydrants. There seems to be no record in the literature of the thawing of mains larger than 6 in., possibly because the larger mains are less subject to freezing.

The current used is commonly an alternating current of high amperage supplied by a special transformer brought in for this purpose. In some instances

portable gasoline motor-driven generating sets of the type used for electric welding are employed. Electric storage batteries have also been used for this service.

In order to thaw service pipes of ¾-in. to 2-in. diameter, currents of 250 to 400 amperes are required, according to a paper by Mr. A. G. Pierson published in the March 1935 Journal of the American Water Works Association. Currents up to 600 amperes are required for thawing iron pipes up to 6 in. in diameter, according to a paper by W. P. Dobson, Chief Testing Engineer, and his associate, W. B. Buchanan, of the Hydro Electric Power Commission of Ontario, presented before the 1935 annual meeting of the Canadian Section of the American Water Works Association.

These heavy currents, unless carefully controlled, can cause considerable damage, even though the voltages used are low. Trouble is likely to occur if there is a return path having resistance lower than the pipe to be thawed. In such cases the thawing current, or part of it, may be diverted through electrical connections in near-by houses and cause fires. Such a fire occurred in Unionville, Conn., on February 2, 1935. In this instance employees of the local public utility company were attempting to thaw a frozen pipe by the electrical method. An armored cable in contact with a water pipe in a house on the opposite side of the street became overheated and burned the floor timbers. The fire was extinguished with minimum damage.

The electrical thawing method is only practical where the piping provides a continuous electrical path. The presence of joints with high resistance may cause local heating and damage the pipe or cause leaks. On this account the electrical thawing method has not been recommended for cast iron pipe with lead substitute joints. However, with a knowledge of the character of the joints and control over the current used, damage to joints should not be a serious factor.

The following, extracted from a paper entitled "Thawing of Ice in Water Pipes by Electricity," published in the November 1935 issue of the Bulletin of the Hydro Electric Power Commission of Ontario, is based upon the results of experience in more than three thousand thawing operations in various municipalities in Ontario and outlines the precautions necessary for the successful application of this method.

### Damage to Pipes or Fittings.

In the case of ordinary ¾-inch service pipes, currents up to 300 amperes should cause no damage in the piping except at rubber-gasketed unions. This may be avoided by providing an electrical by-pass around such fittings. Connections to the operating rod of a shut-off valve should be avoided. The most difficult services to thaw are those using lead or copper pipe coupled to iron pipe, since the heavy currents necessary to thaw ice in the lower resistance copper or lead pipe may damage the iron pipe. Such a case requires careful handling and for copper pipes may require currents in excess of the usual 300 to 600

ampere supply. It has been noticed in several cases that a thawing operation loosens scale or rust in the pipes, which may result in blocking a valve.

In thawing mains of 3 to 6 inches diameter, currents of 400 to 600 amperes may be required for from fifteen minutes to over an hour and attempts to thaw such mains by connecting to a service pipe on each side of the frozen section are likely to damage the smaller pipe. If it is impossible to make connections to hydrants or to the main itself, two or more services should be connected by jumpers in order to properly distribute the current. A clamp-on ammeter provides a convenient means of checking such current distribution. The use of butt joints, and various gasket materials, in mains, may result in damage at the joints. In most cases, such concentration of heat at joints will be indicated by an erratic ammeter reading as voltage is applied, indicating intermittent breakdown of the joint insulation.

The finding of burst pipes after thawing sometimes throws suspicion on the electric thawing operation as the cause, but the possibility of generating sufficiently high temperature steam to develop bursting pressure is extremely remote.

### Damage to Gas Piping and Electric Wiring.

To guard against overheating of gas pipes, or sparks adjacent to gas pipes or meters with their attendant fire hazard, all connections between the gas and water piping systems should be removed, and all crossovers or other points of contact insulated during the application of current.

The electrical neutral conductor, when bonded to the water piping system, may divert a large part of the current and this has been known to cause fires during thawing operations. Such diversions may be conveniently checked by means of a clip-on ammeter, and may be prevented by removal of the neutral connection. In case of breakdown of high voltage insulation of the pipe-thawing transformer, the neutral connections at near-by houses to the same water main should protect against hazardous voltages on the water piping system. Where an existing distribution transformer is being used for pipe thawing, it is imperative that the neutral connection at the transformer secondary be removed, otherwise current will feed back through the secondary neutral to adjacent water pipe connections, and may seriously overload the transformer.

Failure to remove neutral connections from a service pipe will frequently cause several telephones in the neighborhood to ring while the thawing operation proceeds. Not only is this annoying, but it may be dangerous, since it indicates a raising of ground potential in the district affected to between 40 and 50 volts.

### Prevention of Electric Shock.

When a primary supply to the thawing transformer is used, the primary connections should be made by a qualified lineman, and where any temporary high voltage conductors are accessible to passers-by or curious children, a man should remain on guard continuously.

On the secondary side, the voltage will usually be 110 volts or less, but due to the damp locations and large areas of pipe exposed, even this voltage may be dangerous. Residents in the house whose service is being thawed should be warned to keep clear of all water piping and electrical appliances. It is quite conceivable that a hazardous potential may exist between a kitchen tap and a grounded electric stove frame, or between the water supply pipes and drain pipes, especially if the electrical neutral has been removed from the water piping to prevent it overheating.

Poor clamp connections, insulated joints, or other discontinuity in the secondary circuit may cause steep voltage gradients, necessitating the use of rubber gloves in handling any secondary connections and guarding of exposed parts of the circuit from accidental contact.

The Tacoma Hotel before the fire. The gabled wooden shingle roof burned furiously, showering embers over the large warehouses shown at the right along the waterfront. Three of the five outside iron fire escapes may be seen in this picture. Only a small proportion of the rooms had direct access to these escapes. At the extreme left of the picture may be seen the fire department headquarters station. (See also Frontispiece.)

Special precaution is necessary in thawing pipes connected to watering troughs or other farm equipment with which live stock may come in contact, since voltage gradients which are harmless to humans may be fatal to live stock.

### Prevention of Further Freezing.

A satisfactory pipe-thawing operation consists not only of restoring a flow of water through the pipe, but in preventing the water freezing again if at all possible. When water in a pipe freezes the surrounding soil will be colder than the pipe itself, and frost will have penetrated a certain distance below the pipe. If sufficient current is used to thaw the ice along the inner surface of the pipe in two or three minutes, it is evident that the surrounding soil will remain below freezing point. If sufficient water is available to permit the constant running of a tap, the pipe may remain clear. In addition to recommending the constant running of water for at least a few hours, it may be worth while to continue the electric heating process until the entire pipe and surrounding soil have been warmed. An extra fifteen minutes on the job may save a return call and a dissatisfied customer.

# The Tacoma Hotel Fire.

**By Washington Surveying and Rating Bureau,**
**(Member N.F.P.A.).**

The Tacoma Hotel, a famous landmark of Tacoma, Washington, was destroyed by fire early on the morning of October 17, 1935, with a loss of approximately $320,000. Spectacular rescues and numerous narrow escapes accompanied the escape of the 126 guests and employees. Delay in promptly calling the fire department and inferior construction of the building, which included wooden floors, roof, and interior partitions and numerous unprotected vertical openings, together with the lack of automatic sprinkler protection, were prominent factors contributing to the rapid destruction of this popular old hotel.

### Construction and Arrangement.

The hotel, designed by the well-known architect, Stanford White, was built in 1884. It was a large rambling structure 27,610 square feet in ground area and five stories and basement in height with the fifth floor located in the gabled roof portions. The exterior walls were mainly of brick construction twelve to twenty inches in thickness. About fifteen per cent of the exterior walls, chiefly at the top floor, and a one-story section in the rear which included a dining porch, were of frame construction. Floors and roof were of ordinary wooden joisted construction with the exception of the basement and kitchen floors and the ceiling over the boiler room, which were of reinforced concrete and hollow tile. Floors were pierced by many unprotected vertical openings, and basement and attic areas were not provided with fire stops. The interior finish was wooden lath and plaster on wood studding, well seasoned by years of service. Exposed woodwork was coated with many layers of paint or varnish.

**The Tacoma Hotel before the fire. The gabled wooden shingle roof burned furiously, showering embers over the large warehouses shown at the right along the waterfront. Three of the five outside iron fire escapes may be seen in this picture. Only a small proportion of the rooms had direct access to these escapes. At the extreme left of the picture may be seen the fire department headquarters station.** (See also Frontispiece.)

This hotel had the usual basement occupancies, including a bake sho kitchen supplies storeroom, boiler and incinerator room with boilers not service as steam was purchased from an outside central heating plant, buildi maintenance shop, hotel laundry, and a small paint storage room. Tena occupancies in the basement were a barber shop, tailor shop and photo rapher's studio. The first floor contained dining rooms, kitchen, lobby and few guest and lounging rooms. The second, third, and fourth floors consist of guest rooms and the fifth floor was used as employees' quarters and stora rooms. The building was generally well maintained and housekeeping cond tions were considered satisfactory.

Fire protection facilities did not include automatic sprinklers. A goo supply of chemical extinguishers was provided and there were inside stan pipes with two hose outlets on the roof and each floor except the first. D standpipes for fire department use were also located at three of the five exteri iron fire escapes with which the building was equipped. Alarm systems co sisted of central station supervised tour night watchman service with manu fire alarm boxes located on each floor except the fifth, and connected to t public fire department through the central station supervisory office. A loc "break-glass" alarm system with electric gongs on all floors apparently w not used.

### Story of the Fire.

The fire started in combustible material behind a work bench in the buil ing maintenance shop in the basement. The night engineer was making repai in the kitchen about 5:45 A.M. While engaged in this work it was necessa for him to obtain screws from boxes on the work bench in the maintenan shop. It is assumed that while searching through the boxes he laid down dropped a cigarette, which caused the fire.

About 6 o'clock a baker on duty smelled smoke, but thought that it ca from switch engines in the near-by railroad yard. Continued presence of t smoke caused him to make an investigation about 6:10 A.M. He found t carpenter bench in flames. Immediately he seized two dry powder tube ty extinguishers and threw their contents on the bench, but with no appare result. He then ran to a near-by standpipe, but before unreeling all the ho he turned on the water. This caused the remaining hose to swell and stick the reel. He attempted to remove the hose and apply the water, but before could do so a rubber motor belt was ignited. The dense smoke from the b forced him to retreat for help.

Employees in the kitchen reported that they saw smoke coming up t dumbwaiter shaft shortly after 6 o'clock. They notified the night clerk of t fire and he immediately started arousing the hotel occupants by telepho Within two minutes the telephone system went out of service and the ava able employees were sent through the halls to awaken guests.

The fire department was not called until 6:19 A.M., when the first alarm was sent over a central station manual box in the lobby. The fire department responded at once from a station across the street from the hotel. It is reported that an earlier attempt was made to give an alarm when a Japanese house boy was sent to the fire station, but being confused by the closed apparatus doors he returned without notifying the firemen.

**Direct hydrant streams from a six-inch main in front of the hotel in service at an early stage of the fire shortly after rescue work had been completed. Heavy smoke and flames issuing from the upper portions of the building show how rapidly the fire spread from the basement to all portions of the building while firemen were engaged in rescue work. The outside standpipe at the right of the fire escape shown in the picture was not used due to the great headway of the fire.**

**View taken at the main entrance of the hotel as the fire burst through the roof over the elevator shaft at 7:05 a.m. At the left smoke may be seen pouring from between every crack in the cedar shingle roof, which was entirely in flames five minutes after this picture was taken. Water from the ineffective direct hydrant streams is shown running down the face of the building.**

When firemen entered the building heavy smoke filled the north sectio of the basement. An effort was made to use hose streams in the basement, bu smoke and heat were so intense that the fire could not be reached. Fire fightin activity was quickly discontinued and the firemen promptly commenced rescu work. A direct third alarm was sent in at 6:23 A.M. to obtain additiona equipment and men. The firemen and employees hurried through smoke fille halls knocking on doors, shouting an alarm and directing guests to fire escape and accessible stairways. By 6:30 the entire building was full of smoke an

*Acme.*

**Left: Rescue efforts at the rear of the hotel. Smoke which may be seen coming from the basement made stairways and elevators impassable. Firemen may be seen helping one of the occupants clad in night clothing down a ladder. The men on the right are raising a pompier ladder to rescue occupants trapped above. The fireman on the ground is waiting to go up the ladder with a life line. The small ladder hooked in the window at the center of the picture is a roof ladder from a hose truck used as an improvised scaling ladder in the emergency. Right: A spectacular rescue of a woman guest from a fourth floor window in the rear of the hotel. She is climbing down a rope of sheets held by her husband. A fireman wearing a gas mask is coming to their assistance with a pompier ladder. The precarious position of the ladder on which the fireman was standing was made necessary by the projecting one-story section, which also made the use of life nets impossible.**

many occupants could be rescued only by means of ladders. In several i stances rescues were accomplished with pompier (scaling) and aerial ladder

The fire spread so rapidly through unprotected stairways and verti openings that by the time everyone had escaped, heavy clouds of smoke we pouring out of the exterior wall openings and under the eaves of the ro Flames spread up through the open elevator shaft at the front center of t structure, burst through the roof at 7:05 A.M. and within five minutes t entire roof, a considerable portion of which was covered with cedar shingl was ablaze.

Direct hose streams which were used during this stage of the fire were n effective because of inadequate pressures available and the small size of t main in front of the hotel, reported to be six inches in diameter and havi static pressure of sixty-five pounds. In response to the chief's call for mo water, gate valves to the intermediate service were opened by the water d partment. Pumpers were placed at hydrants on larger mains located one blo from the hotel, and approximately ten streams delivered at high pressu through an aerial ladder pipe and several turret pipes on fire apparatus as w as hand operated streams. Nine engines, two ladder trucks and one hose co pany fought the fire. By 7:45 A.M. the fire had burned down to the seco floor level and the roof had completely fallen in. Burning embers fell in sho ers on several large dock warehouses along the waterfront in the rear of t hotel. Hose lines were run to the warehouse roofs, which were kept wet dow By 8:30 A.M. the fire was brought under control by the continued applicati of heavy streams, but not before the hotel was entirely destroyed.

## Conclusions.

The fire demonstrates the advisability of turning in a prompt alarm. T fallacy of withholding an immediate fire department alarm and attempting extinguish incipient fires was brought to light in the investigation followi the fire when it was learned that approximately ten minutes elapsed betwe the actual discovery of the fire and transmission of the alarm to the fire d partment. The need for a positive local alarm for arousing the occupants the building was evident. An automatic alarm system reporting to the f department would have avoided the waste of much valuable time and mig have resulted in the fire being extinguished without material loss.

The fire also shows the necessity of installing automatic sprinkler equ ment in hotel buildings of combustible construction. In this case there is eve reason to believe that sprinklers would have confined the fire to the wo bench at which it originated.

Lack of protection of vertical and horizontal openings contributed to t rapid spread of the fire and greatly increased the life hazard. It is consider miraculous that all occupants were saved.

# Glidden Soybean Plant Explosion.

By David J. Price and Hylton R. Brown.*

An explosion which caused the death of 11 men and injured 45 others occurred at the soybean processing plant of the Glidden Company in Chicago, Illinois, at 11:38 A.M., on Monday, October 7, 1935. The processing section of the plant located at 1845 North Laramie Avenue was almost totally destroyed with a loss estimated at $600,000. Considerable glass was broken in surrounding residences and business properties.

The Glidden Company, with national headquarters at Cleveland, Ohio, operated the Chicago plant for the production of soybean oil, meal, protein and lecithin. It had a capacity of about 4000 bushels of beans a day.

## Description of Plant.

The accompanying sketch shows the arrangement of the different units of the plant. Some of the buildings were new, while others were old buildings which had recently been remodeled. Reports indicate that all were well maintained and in good condition. The extraction unit had been shut down for about 4 weeks awaiting the new crop of beans and this period was used for making repairs, improvements, painting and general overhauling of buildings and equipment. The principal buildings in the section affected by the explosion and shown on the drawing are the elevator, the bean preparation building, the extraction building, the lecithin building, the protein building, the tank building and the warehouse.

The elevator, a modern concrete and steel storage plant, similar to a wheat or corn-handling plant, consisted of a work house and 4 large cylindrical tanks 100 feet high. This building was not involved in the explosion, and the principal damage consisted of broken glass and chipped concrete.

The bean preparation building was a 4-story brick and steel structure which housed the bean cleaning, cracking and flaking equipment. It adjoined the extraction building, but was separated from it by a heavy brick fire wall, 14 to 16 inches thick, which was pierced in only two places, one at the top and one at the bottom, for the transfer of the bean flakes to and from the extraction building.

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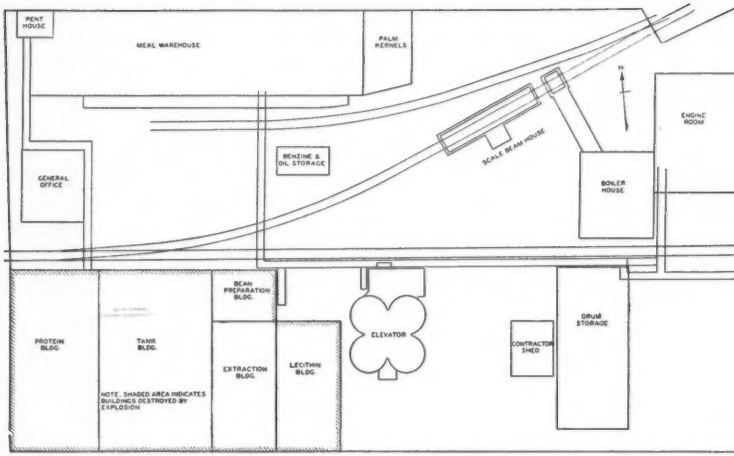



**Diagram of the Glidden Soybean plant.**

The extraction building was also of brick and steel construction, 4 stori high. Some of the equipment extended through several floors.

The buildings known as the protein section, located west of the bea preparation and extraction units, were 5 and 6 stories high and of brick ar steel construction. The fire wall around the extraction unit formed part the dividing wall between the two sections, and a tile wall in line with the fi wall completed the separation from the bean preparation unit. The prote section was divided into two units. The section known as the tank buildi which adjoined the extraction building was without floors. It was open for i full height of about 50 feet with only one central column, which served as middle support for the roof girder. The only equipment in this building w about 15 wooden stave tanks in which different ingredients used in the proce were mixed. This part of the plant had recently been extensively remodeled

The other part of the protein section, referred to as the protein buildin contained some flooring at different levels. At the south end a large steel b or tank extended from about the second floor level to the top.

The lecithin building, one of the newer units of the plant, adjoined tl extraction building on the east. It was of steel, concrete and brick constru tion with large window area, and had 4 floor levels. Fire doors protected tl openings in the wall between it and the extraction building.

Electric power was used throughout the plant, and underwriter's inspe tion reports state that approved explosion-proof motors and equipment we used in all locations where flammable vapors or dusts were considered to be hazard. Electric lights had vapor-proof globes, and where there was consi

ered to be any explosion hazard, wiring was in conduit with approved explosion-proof switches.

Steam heat was supplied by radiators and unit heaters with air circulating fans.

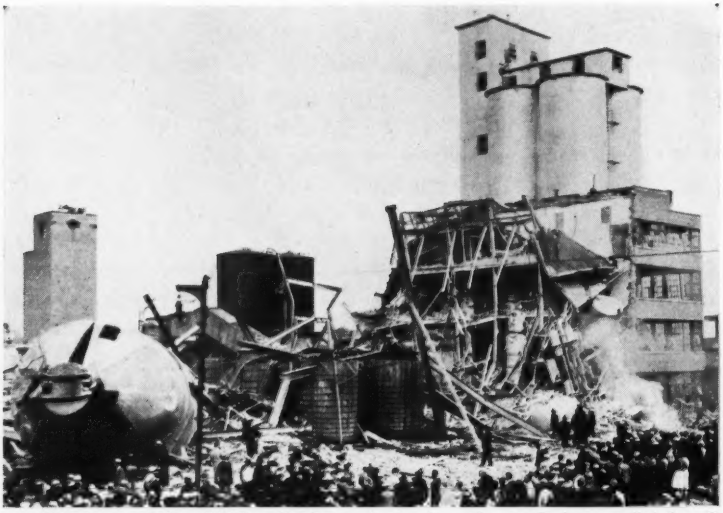
### Description of Process.

At the elevator, beans were unloaded from cars and stored or elevated to the top of the house for transfer to the processing part of the plant. From the elevator the beans passed through an 8-in. pipe by gravity to the top floor of the bean preparation building. Here they passed over separators, through scales and up an elevator leg into a tank over a cracking roll which cracked the beans into 3 or 4 pieces. From the cracking roll the stock passed through a drier or temperer to the flaking roll. The flakes, 3/8 in. to 3/4 in. in diameter, fell to a belt conveyor which carried them to a second elevator leg. From the top of this leg the stock flowed through a spout which passed through the brick wall into the extraction room where a belt conveyor carried it to the top of the extraction tower. This tower, a U-shaped apparatus, was about 28 ft. high, with tubes 39 in. in diameter. Screw conveyors with perforated flights operated downward on the entrance side across the bottom and upward on the discharge side. Hexane was pumped to the intake side of the tower, and the oil and hexane mixture was drawn off and piped to the distilling column, where the hexane was recovered and put back into the process.

The extracted flakes from the discharge side of the extraction tower passed through a spout to the drier, a series of steam-heated drums through which the material was carried back and forth and finally discharged into a screw conveyor on the first floor. This conveyor, set at an incline, carried the stock to the cooler, and the discharge from the cooler passed through the wall into the bean preparation building. Here it was elevated and dropped into an air stream, which carried it through an overhead pipe line to the bagging or warehouse section at the northwest corner of the plant, where it was caught in a cyclone and discharged to a packing bin.

In the lecithin plant, oil separated from the hexane at the distilling tower was processed to obtain lecithin, a product used in candy and chocolate coatings. The oil is used as an edible product and also in the manufacture of paints.

In the newly remodeled end of the plant known as the protein building, the extracted flakes, received either directly through a roof conveyor from the bean preparation building or in sacks after being bagged at the warehouse, were treated to produce protein in a powdered form similar to casein. In the process batches of flakes or meal were mixed with warm water in slurry tanks in the south end of the protein building and then pumped into one of the south six tanks in the tank building. In these tanks the material was treated and agitated and pumped back into the protein building where the liquid was



**Wreckage of the Glidden Soybean plant after the explosion on October 7, 1935, in which eleven men were killed and forty-five injured.**

drained off and the residue dried. When discharged from the drier it wa elevated and dropped into the meal bin on the fourth floor, where it was bagge for shipment as meal.

The liquor from the above process was pumped to filter presses on th sixth floor and the press cake from these presses was fed into a drier at th north end of the protein building. After being dried in the oil burner heate columns of the drier, the product was screened and packed for shipment.

## Story of the Explosion.

Operation of the extraction unit had been suspended for a period of abou four weeks because the supply of beans had been exhausted. The new cro had just become available, and the unit had started operating again the morn ing of the day the explosion occurred. The regular employees had been re tained during the shut-down period, and the plant had been completely ove hauled. Piping was taken down, cleaned and painted, new gaskets were fitte and everything was placed in what was believed to be first class conditio With the regular employees on hand for the starting of the plant, no particula difficulty was experienced in resuming operations. The same process in us when the plant shut down was being employed. About three hours after th plant was started some of the employees detected an odor of gas, and one o the foremen in the Protein Department was on his way to report this to th manager when the explosion occurred.

Eye-witnesses and others in the vicinity report that there was apparently one major blast which wrecked the buildings and rocked the neighborhood. Office employees and workers in the laboratory, drafting room and other sections of the plant were showered with broken glass when the windows were shattered. The walls of the protein building, the tank building and the bean preparation building were demolished, and the bricks scattered for some distance in all directions. Many automobiles parked near the plant were damaged when falling débris crashed through their tops. The extraction building and the lecithin building were wrecked, but the floors did not drop and some of the equipment remained in place. Both buildings, however, were so badly damaged that it will be necessary to tear down or realign the parts which remained standing. The south wall of the warehouse was bulged outward, and it will be necessary to rebuild it.

The fire and police departments responded promptly, and ambulances rushed the injured to hospitals. Fortunately no fire broke out in the ruins of the demolished buildings, and the fire fighting activities were limited to extinguishing a fire in an automobile probably due to a short circuit caused by falling material. Rescue work was started promptly and continued day and night until all bodies were recovered. At the same time investigations were started by the company and other agencies to determine the cause of the explosion and develop methods of guarding against a repetition of such an occurrence.

## Conclusions from Investigation.

Before attempting to draw conclusions consideration was given to the possible hazards present in the process used at this plant. At the elevator where the beans were received and stored the same dust explosion hazard existed that would be present in a similar elevator handling grain. In the bean preparation building where the beans were cleaned, cracked and flaked practically the same dust explosion hazard existed as in a feed mill. The extraction unit was considered the hazardous part of the plant, both by company officials and insurance inspectors, because of the use in this section of hexane* for the extraction of the oil from the bean flakes. At the other end of the plant in the protein building was another dust explosion hazard. At this point in the process press cake from the filter presses was broken up, dried in an oil-fired flash type drier, ground, screened and sacked. Here again the dust explosion hazard would be similar to a feed preparation plant with the additional hazard of the oil-fired drier.

*Hexane is a light flammable liquid with flash point of 0° F. or lower. The vapor is explosive in mixtures with air, with explosive limits 1.1% to 4.2% according to data from a solvent producer. The maximum rate of flame propagation occurs with a 2% mixture. The specific gravity of the vapor is 2.97 (air = 1).

**The southwest corner of the plant as it appeared from the top of the elevato tanks.**

In drawing conclusions attention has been given to statements of co pany officials regarding the process in use at the plant, as well as stateme of employees concerning operating conditions before and at the time of explosion. A study has been made of the building layout and machinery lo tion, and the ruins have been inspected as far as possible for any evide which would indicate the point of origin and source of the ignition.

It seems to be generally agreed by those studying the ruins that the exp sion centered in the upper part of the tank building of the protein secti and the consensus of opinion is that it was an explosion of gas. The m ner in which the building walls were shattered and the absence of fire lowing the explosion indicate that the explosive mixture was gas and air proportions conducive to the rapid passage of flame. This opinion is uph by the statements of employees who said that they smelled gas before explosion and the fact that the manager and other officials were in the pla endeavoring to find the source of the gas leak.

At variance with this conclusion is the fact that the only man burned the explosion was the employee stationed at one of the flaking rolls in bean preparation building and the evidence that the circuit breaker of motor on one of the flaking rolls had opened four or five times during

morning. He thought he might have been burned by a flash of flame from the motor, but feels that the big explosion came from the protein building.

The problem in the investigation has been to determine how the gas accumulated in the tank building and how it became ignited. From the evidence assembled it is our opinion that gas from the extraction building passed into the tank building at or near the top of the fire wall separating the two units, or possibly through the pipe carrying condenser water into the tank building. The tank building, a large open area without floors in its 50 ft. height, had little or no ventilation because the weather was cool and windows had not been opened. Probably a large pocket of gas accumulated at that point. The gas could have been ignited when the flash occurred at the flaking roll. In fact it is quite likely that the burns received by the employee at the flaking roll were received in a mild or minor dust explosion at that point. This flash, passing through the doorway between the bean preparation building and the tank building, could have been the source of ignition for the main explosion which wrecked the plant. It is also possible that gas was present in the bean preparation building as well as in the tank building and that the motor circuit breaker opening or a flash at the roll provided a direct ignition for the gas and air mixture.

### Recommendations for Explosion Prevention.

As a result of the study of the process made in connection with this investigation it is recommended that certain precautions should be taken in plants of this kind to guard against dust explosions as well as vapor explosions.

(1) In elevators handling soybeans, the safety code for the prevention of dust explosions in grain elevators as prepared by the Dust Explosion Hazards Committee of the National Fire Protection Association should be followed.

(2) In plants grinding or milling soybeans or preparing them for processing, the safety code prepared by the same committee for the prevention of dust explosions in flour and feed mills should be followed.

(3) Soybean elevators and buildings in which grinding, milling or other preparatory processes are performed should be segregated from other sections of the plant, and should have vents in the walls or roof to release explosion pressures without structural damage. Such vents, in the form of hinged sash or light panels, should have an area of one sq. ft. for each 80 cu. ft. of the building, room or bin.

(4) The same precautions suggested for soybean milling or preparation units should be adopted in plants preparing protein from soybeans, particularly in the drying section.

(5) Dryers in all parts of a plant where flammable dust is present should be separated from other sections of the plant, and the outside walls should be equipped with the above recommended amount of venting facilities.

(6) Dust collectors should be installed outside or vented outside of the building.

(7) To guard against any inherent dust explosion hazard, special attention should be given to the type of drier used.

(8) In soybean processing plants using the extraction process all possible precautions should be taken to provide for the safe operation of such units because the solvents generally employed constitute a fire and explosion hazard.

(9) Where hazardous solvents are used consideration should be given to the practicability of installing instruments which will detect the presence of flammable vapors and give warning when the concentration approaches the lower explosive limits.

(10) Attention should be given to the development of a non-flammable solvent for use in such processes.

# A Rural Soybean Plant Explosion.

By David J. Price,*
(Member N.F.P.A.).

On October 22, 1935, about 3 P.M., an explosion occurred in the soybean oil extraction unit, owned and operated by Varnum Parish, Jr., at Momence, Illinois. The owner and his assistant were killed, and two others, the plant fireman and a visitor, were injured. The unit was one of the first installations of this type on a rural community basis to be installed and operated in this section of Illinois. The explosion, which occurred about six hours after the plant had started operating, created considerable interest throughout the Middle West in the practicability of farm and rural community installations for soybean utilization.

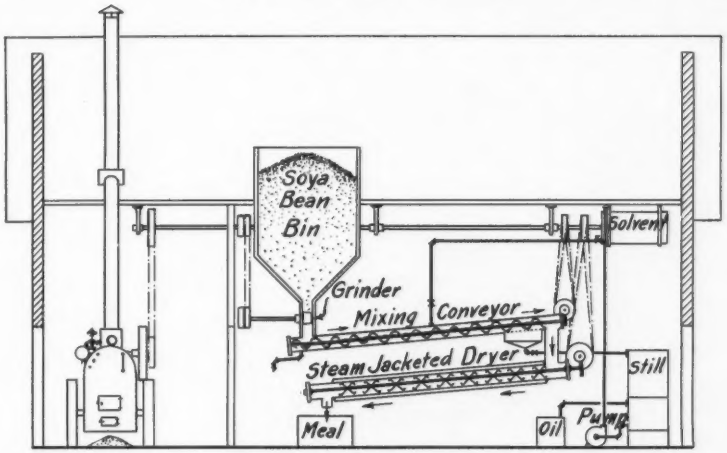
## Description of Plant.

Varnum Parish, Jr., after graduation from one of the Middle West universities in June, 1935, devoted his attention to the possibility of installing a unit for extraction of oil from soybeans and the production of soybean meal for cattle feed. The equipment was made in a local iron works in a near-by town and installed under the personal supervision of Parish, Jr., in a building at Momence, Illinois, which was formerly used as a chicken hatchery. As near as could be determined by examination of the wrecked equipment, the process was probably carried out as follows:

The soybeans were dropped from a hopper on the floor above into a vertical pipe in which a small grinding mill was installed, as shown in the accompanying sketch. This mill, which was operated by a belt drive, crushed

*The investigation of this explosion was conducted in coöperation with Deputy State Fire Marshal Frank W. Seeger, Streator, Illinois.

See footnote page 233 for connections of author and authorization for publication of this article.




**Soybean Extraction Unit, Varnum Parish, Jr., Momence, Ill. No original drawings available. This sketch based on evidence on the ground after the explosion.**

the beans into meal. The ground product dropped into a pipe about 18 inches in diameter, inclined upward at about 10 to 15 degrees from horizontal, in which a spiral conveyor was installed.

The solvent, a commercial form of hexane, was drawn from a 55-gallon drum on the floor and pumped into the extraction unit above. The hexane solvent entered the pipe, came in contact with the soybean meal as it was carried up by the spiral conveyor and extracted the oil. The extracted oil was carried off to receiving tanks, and the solvent recovered.

The oil-free meal dropped into another pipe set at about the same angle and located directly underneath the extraction pipe. In this pipe, which was steam-jacketed, the residual solvent was driven off as the meal passed through. The meal was then discharged into a container.

The hexane was purchased from a commercial oil company in a shipment of five drums, each containing 55 gallons, or a total of 275 gallons.

The steam for the soybean meal drier and for other purposes was supplied by a tractor engine boiler installed in an adjoining room.

### Story of the Explosion.

The investigation of this explosion revealed that plans were made about 2 P.M. to get the extraction unit ready to resume operation after a previous short run in the forenoon. This consisted of running the beans from the hopper down through the grinder and into the extraction unit and also in pumping the hexane solvent from the containers on the floor. Apparently about one

**Wreckage of the soybean extraction unit, Momence, Ill., after the explosion on October 22, 1935, in which two men were killed and two injured.**

hour after these operations were started, or about 3 P.M., the explosi occurred.

A short time before the explosion took place a local man arrived at t plant to observe the operation of the new soybean unit. He stated that observed an odor of "gas" which he called to the attention of the operato who apparently had not been able to detect anything unusual. About t minutes later the explosion took place. This observer was standing near t end of the unit next to the boiler room, and was blown out through a near- door. He was burned about the head and hands. He stated that he saw f flash from the fire box in the boiler room and heard a second explosion which believed blew both operators out the door at the opposite end of the buildi

The plant fireman had helped get the unit started and was standing front of the fire box in the boiler room when the explosion occurred. The fi thing he observed was that his trousers were on fire. He did not hear a violent explosion, and stated that the force of the blast seemed to be in t opposite direction from him, or toward the far end of the building.

## Cause of the Explosion.

From this investigation, it is very evident that hexane* vapors we escaping from the extraction unit which apparently were not detected by t

*See footnote page 237 for data on the properties of hexane.

operators. The heavy vapors settling in the extraction room apparently were carried over through the open door to the fire in the boiler room and ignited in the fire box. This first ignition of hexane gas spread into the extraction room, causing what witnesses called the second explosion, which blew the operators through the door at the opposite end of the building.

### Recommendations for Rural Community Unit Installations.

The investigation of the explosion has developed the following recommendations which it is believed will be helpful in the further development of plants for soybean utilization.

(1) Safety measures should be developed for explosion prevention in farm and rural community installations of this character.

(2) Attention should be directed to the possibility of developing a non-flammable solvent for soybean extraction units for farm and rural community use.

(3) If non-flammable solvents are not practical and efficient for operating reasons, the use of flammable solvents must be surrounded with effective practical safety measures.

(4) In any rural community installations involving flammable solvents, provision should be made for underground storage of the solvents outside of building walls.

(5) All electrical apparatus and equipment should be of the approved type, installed in accordance with requirements of the National Electrical Code.

(6) Provision should be made for ventilation in units of this kind, so that any escaping gases or vapors can be carried outside the building.

(7) The boiler room and any other sources of open flames should be safely separated from the main extraction unit.

(8) The building in which the extraction unit is installed should be so constructed as to provide adequate venting area to relieve any pressures from explosions or fires.

(9) Provision should be made by local authorities for adequate inspection of units of this kind before operations are undertaken.

# Peoria Whiskey Warehouse Fire.

The largest loss fire of the year 1935 occurred in Peoria, Illinois, on t evening of July 22, 1935, in the plant of Hiram Walker & Sons, Inc., whisk and gin distillers. The fire originated in whiskey warehouse No. 3 which co tained some 80,000 barrels of whiskey and extended to the adjoining ciste and shipping building and the bottling building. The loss is variously es mated at from $2,000,000 to $3,000,000, the largest part of which was t whiskey. In addition to this direct loss the Government suffered a potent loss of $8,500,000 in taxes, according to the statement of H. W. Rubel of t Peoria Bureau of the Internal Revenue Office.

This fire was the fourth large distillery loss since the repeal of Prohibiti and has served to focus the attention of fire protection engineers on the haza of this type of property where large values are concentrated and subject the severe hazard of alcohol storage and handling. The other large distille losses since repeal were those at the Pepper Brothers plant at Lexington, K on April 28, 1934, where the loss was $2,655,467 (see QUARTERLY, July 193 page 79); the fire at the Penn-Maryland Corp. at Peoria, Ill., on March 1 1935, where the loss was $568,172 (see QUARTERLY, April 1935, page 302 and a fire in the plant of the Empire Distilling Co. in Philadelphia, Pa., June 29, 1935, which was destroyed with a loss estimated at $250,000 aft being struck by lightning.

Warehouse No. 3 was a rack warehouse, completed during 1935, repr senting the latest thought in structures of this type. It was complete equipped with automatic sprinklers, having an ample water supply from 1 inch looped mains. The construction and arrangement of this warehou which was generally similar to the other warehouses in the plant, are given the article on page 317 of the April 1935, QUARTERLY, which describes te to show the effectiveness of automatic sprinkler protection in this class of o cupancy. The building was a typical open rack bonded warehouse with hea brick walls. There were no floors except narrow catwalks and center ais ways. Barrels of whiskey were supported on a system of timber racks. T concrete basement was designed to have sufficient capacity to retain the ent contents of the barrels in case of accident, thus preventing the flow of burni liquid.

The exact circumstances of the origin of the fire are not altogether cle Testimony at the coroner's inquest on the death of an employee indicat that prior to the fire some tilting of the wooden supporting structure had be

In the absence of an authentic N.F.P.A. report on this fire, the accompanying text been extracted from various periodicals.—Ed.

*Courtesy Sherman V. Coultas.*

**The blazing ruins of Warehouse No. 3, where some 70,000 barrels of whiskey were destroyed. This picture was taken from between the Cistern and Shipping Building (right) and the Bottling Building (left).**

noted and that men were at work in an endeavor to keep it in proper alignment.

With little or no warning the entire rack structure collapsed, carrying with it the brick walls of the building and dropping the barrels, many of which broke and released their contents outside of the line of the walls of the building. First reports indicated that there was an initial explosion. Other reports stated that the collapse preceded the fire.

Whatever the originating cause, it is clear that the whiskey released from the barrels immediately ignited and caused a fire of tremendous intensity. All the sprinkler piping collapsed with the building. In order to prevent the loss of water through the broken sprinkler risers and conserve water for hose streams, it was necessary to close valves on the loop main system. The severity and spread of the fire were such that valves near the burning ruins of warehouse No. 3 could not be reached, and it was necessary to shut remote valves, which cut off the supply to sprinklers in the adjoining bottling building and cistern and shipping building. Without the benefit of sprinkler protection these adjoining buildings were soon ignited.

Three fire department companies responded to the first alarm at 10:25 P.M., which was followed by a second and a general alarm. Five pumpers, four ladder trucks and three hose trucks were in use. The fire was fought by fire department and plant employees, using sixteen hose streams fed by pumpers and directly from hydrants on the ten-inch mains. The fire pump was promptly started and the pressure raised to 145 pounds.

Weather conditions were favorable for fire fighting. The fire was considered under control about 2 A.M., July 23, but hose streams were used for several days to cool the débris. Ten thousand barrels of whiskey were salvaged from the ruins.

*International.*

**The ruins on the morning of July 23.**

# Cook Paint and Varnish Company Fire.

An explosion of flammable solvent vapors in a mixing machine, followed by fire, severely damaged a fire-resistive building in which pyroxylin lacquer was manufactured at the plant of the Cook Paint and Varnish Company at North Kansas City, Mo., on October 24, 1935. The fire also damaged an adjoining building of the plant occupied as a glass warehouse and caused a loss of approximately $250,000. The large loss in this fire-resistive building is attributable to the concentration of large amounts of flammable solvents; and their handling in containers which were not tightly closed. A single source sprinkler system in each building, supplied only from a six-inch public water main, failed to control the fire when fire department pumpers took all available water from the main.

### Construction and Occupancy.

The property in which the fire occurred is a large paint, varnish and lacquer manufacturing plant, and includes a jobber's business handling painters' supplies, wall paper and glass. Plant buildings are from one to three stories in height. Fifty-five per cent of the plant is of fire-resistive construction. Outside the buildings are a number of solvent storage tanks.

The fire started in Building No. 22, occupied principally for the manufacture of pyroxylin and other lacquers and having a capacity of approximately twenty-five hundred gallons a day. This building was of modern reinforced concrete construction, three stories and basement, with twelve-inch brick curtain walls having large steel frame window openings. Windows on the front and rear were equipped with plain glass and those on the sides with wired glass. None of the windows were equipped as explosion vents.

The third floor was used as a research laboratory and for the storage of records. The second story contained two 1100-gallon and three covered 1600-gallon solvent tanks. These tanks were filled by piping from outside solvent storage tanks by means of air pressure. Gums were stored on this floor and about twenty enamel grinding machines were located here. Nitrated cotton was brought in as needed. On the first floor were three 1000-gallon turbo-mixers for the manufacture of lacquer. These mixers were charged with nitrated cotton mixtures and solvents through fourteen-inch sheet metal ducts extending from the second floor down to holes in the covers of the mixers. The solvents were supplied by gravity through a pipe which apparently did not extend down into the liquid. Finished lacquer flowed by gravity from the first floor to the lacquer can filling and storage department in the basement. The basement also contained a cut-off boiler room which heated the entire plant.

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This article has been condensed from reports of the Missouri Inspection Bureau (Member N.F.P.A.) and the Underwriters Service Association (Member N.F.P.A.).

**Extent of fire at 4:30 p.m., showing fire on first floor practically extinguished and fire on second floor under control of sprinklers. No hose streams are in use. Water from sprinklers may be seen running out of doorway. This picture is taken looking northeast.**

Building No. 23 also involved in the fire was one story in height, of ordinary brick construction with a small basement. The first floor was used for the storage of glass and the basement contained two 10,000-gallon benzol storage tanks and pumps which were not involved in the fire.

Building No. 22 communicated with Building No. 23 on the north through a first floor opening protected by a single standard automatic fire door, and with Building No. 3 in the rear through a reinforced concrete bridge at the second floor protected by standard automatic fire doors at each end of the bridge.

### Fire Protection Facilities.

The plant protection includes watchman with central station supervisory service. Sprinkler systems, completely supervised by central station service, cover 85 per cent of the plant. First aid equipment consists of numerous 2½-gallon chemical extinguishers with additional 33-gallon foam extinguishers. A well-organized private fire brigade is maintained with a siren signal system and equipment including a portable foam generator.

The public fire department apparatus consists of two pumpers. Substantial outside assistance from the Kansas City, Mo., fire department is available.

Public hydrants near the plant were supplied by six-inch mains fed by eight-inch. Tests made at a public hydrant following the fire showed 69 pounds static pressure and 30 pounds residual pressure with a flow of 1168 gallons per minute.

Both buildings involved in the fire were fully protected by single source sprinkler systems supplied from the public mains. Building No. 22 was protected by a wet pipe system and Building No. 23 by a dry pipe system with accelerator. Both systems had fire department connections.

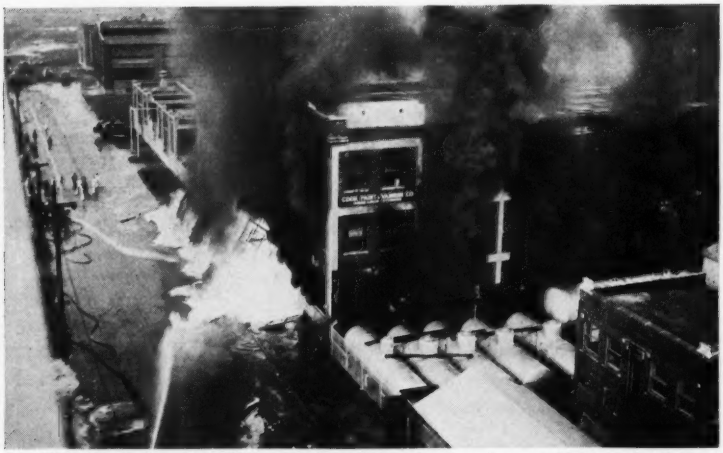
### Story of the Fire.

Shortly before 3:43 P.M. the lacquer mixers on the first floor were shut down for the purpose of recharging with solvents and pastes composed of pigments and nitrocellulose. The charging was done from the second floor by means of a spout fourteen inches in diameter. The opening to the tank is closed by a bolted metal cover when not in use.

One of the tanks had just been charged with a small batch of approximately thirty gallons of lacquer pastes and solvents when an explosion occurred. The cover of the tank was open for sampling. Flame shot through the open cover and charging chute to the second floor. An employee on the first floor immediately sounded an alarm and also attempted to operate a 33-gallon foam extinguisher, but was driven away by burning material on the floor. This material partly came from the second floor, where a tank directly over the filling chute was ruptured, causing its contents to spread in both the first and second floors. Four workmen on the second floor were slightly injured by a slight explosion, which did moderate damage. Some of the front windows were blown outward. Three of the men were driven to the front of the building and forced to drop from the front windows, a distance of 25 ft. to the ground. They escaped practically uninjured. Another man from the second floor made his way downstairs to Building No. 23 and was badly burned. Occupants of the laboratory on the third floor escaped over a catwalk to the top of fuel oil tanks adjoining the building and by other exits.

### Cause of the Explosion.

Electrical equipment consisted of induction type motors controlled by oil switches. Electric lamps and switches were of vapor proof type. Since there was no electrical equipment in operation where the explosion occurred and electric switches were not closed in the circuits, it is assumed that the fire was caused by static rather than other electric sparks. Although grounding of machinery and equipment was fairly adequate, there was no provision for humidification and it is thought that static could have been generated in pouring solvents from hand containers through the open cover of the turbo-mixers, or static sparks or friction at the filling chute may have been the cause.



**Extent of fire at 4:40 p.m. after hose streams have robbed sprinklers of water. Solvent tanks have burst, and containers upset by hose streams have caused burning solvents to flow into the street. Mill fire brigade members, dressed in white overalls, may be seen using foam extinguishers.**

The explosion was seen to originate in the mixer which contained a charge of only about thirty gallons in a tank having a capacity of 1000 gallons. The small size of this charge allowed the major portion of the tank to be filled with flammable vapors as the solvents dropped several feet. A spark, probably static, ignited the vapors within the mixer, causing an explosion which communicated to the immediate surroundings and second floor through the 14-inch feed pipe, which was found crushed on the floor following the fire. It seems likely that if solvents had been handled through a closed piping system or a smaller mixer used this explosion might have been avoided.

### How the Fire Was Fought.

The first alarm was received in Kansas City at the central office of the supervisory system at 3:46 P.M. Their records indicate that both manual and water flow alarm were received at the same time. Alarm to the North Kansas City fire department was received at 3:50 P.M. and the department responded with both its pumpers. The Kansas City fire department responded to the first alarm with one pumper. Additional alarms turned in at 4:08 P.M. and 4:37 P.M. brought two pumpers, one turret truck and one ladder company. The plant brigade also responded, but as the public department arrived before they could put a stream on the fire they devoted their efforts to assisting the public department. Some delay in getting water on the fire by the first pumper was due to false reports that workmen were trapped in the building. Fire fighting was also handicapped by the wired glass windows in metal frames at

**Solvents still burning furiously in front of the building at 5:15 p.m. Extreme heat prevented the use of hose streams at closer range. Building No. 23, damaged by the fire, was located in the rear of the large tanks at the left (north).**

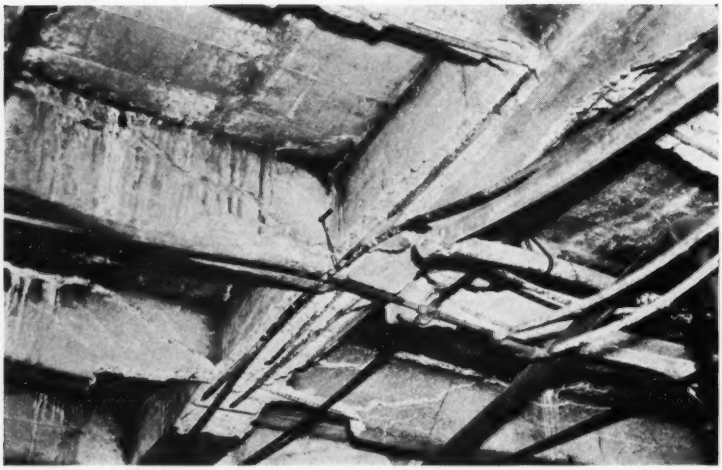
the side windows, which prevented hose streams from reaching the fire, but the wired glass prevented the spread of fire to large solvent tanks adjacent. A very effective stream from the roof of a near-by building was abandoned due to a false report that the fire had spread into the building beneath the men directing the stream. The bursting of solvent tanks and drums added to the intensity of the fire in the building.

Fire is believed to have spread into the glass warehouse, Building No. 23, through a skylight, as the fire door between this building and No. 22 had operated effectively. The fire in this building was controlled by hose streams.

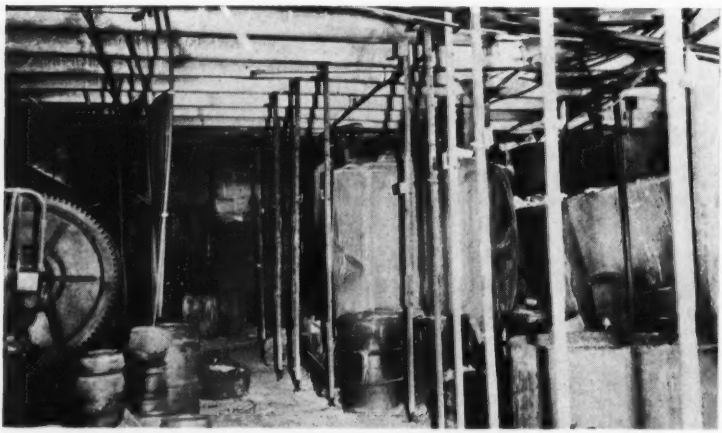
### Effect of Sprinkler Operation.

For the first forty-five minutes the sprinklers appeared to be keeping the fire fairly well under control. There is evidence that the fire in the first floor was practically extinguished. As the fire department continued to place additional hose streams in service the fire department pumpers taking suction from the six-inch main, which was the only source of water for sprinklers, brought the pressure in the main down to zero and deprived the sprinklers of water. At the height of the fire the fire department had twelve hose streams in operation. The fire department did not use the siamese connections to the sprinkler systems, although it is stated that the plant fire brigade suggested this procedure.

After the sprinklers were deprived of water the fire greatly increased in intensity and water from the hose streams caused burning solvent to run from the building through a large shipping door on the first floor into the gutter in front of the building, where it burned with great intensity. The fire traveled



The second floor ceiling, showing the damage to the reinforced concrete. It is probable that had the sprinklers been supplied with water this damage would have been much less severe despite the intense fire from the burning nitrocellulose and solvents.



Solvent tanks and equipment located on the second floor near the point where the fire entered this floor through a chute leading to a lacquer mixer on the floor below. The vertical supports were installed after the fire.

along the gutter for several hundred feet, mostly toward the north, and endangered a number of above ground tanks near the burning building. Fire department hose streams were used to control the fire in the gutter. It is believed that had the plant fire brigade been allowed to use their portable foam generator this portion of the fire would have been more readily controlled. The fire had practically burned itself out by 9:30 P.M. An examination after the fire showed that all sprinkler heads in Building No. 22 and seventy-five per cent of the heads in Building No. 23 fused.

### Extent of Damage.

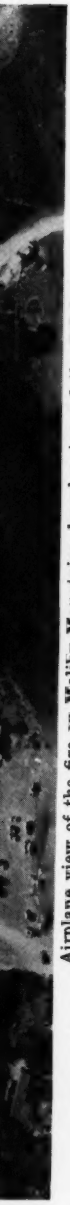
Most of the fire damage in Building No. 22 occurred on the second floor. The basement and third floor suffered little actual fire damage. Numerous cracks and distortions in the walls resulted from the fire and many steel window frames were destroyed or badly warped. The second and third floors were badly cracked and reinforced concrete beams in the area where the fire started were badly damaged. The boilers in the basement were put out of service, necessitating the purchase of steam from outside sources. The machinery, equipment and stock were badly damaged. The roof of Building No. 23 was damaged by fire for a distance of twenty feet. The contents were damaged. The loss included wetting of a large amount of packed glass.

The loss to Building No. 22 was estimated at $50,000, and damage to machinery and stock in this building was estimated at $110,000. Damage to Building No. 23 was estimated at $2000 and the loss to machinery and stock of this building was approximately $14,000. Use and occupancy losses occasioned by this fire are expected to bring the total loss to $250,000.

Airplane view of the fire on Malibu Mountains, burning toward the S.C.C. camp.

# Los Angeles County Forest Fires.

By Spence D. Turner,
Los Angeles County Forester and Fire Warden (Member N.F.P.A.).



Airplane view of the fire on Malibu Mountains, burning toward the C.C.C. camp.

The day of October 23, 1935, became one never to be forgotten in the fire annals of the County of Los Angeles, Cal. On this day four major forest conflagrations started within a period of ten hours, and during the fighting of these fires fourteen other fires occurred in the territory under the jurisdiction of the County Department of Forestry. The number and size of most of these fourteen other fires would not have taxed the resources of the department had not most of its forces been concentrated on two major fires in the Malibu Mountains. The smaller fires were widely scattered and each one was a potential conflagration. The fires of October 23 were the most serious in the county since Labor Day of 1924, when the San Gabriel fire within the Angeles National Forest burned for seven weeks, covering an area of 65,000 acres.

The following tabulation of the nine principal fires for the week beginning October 23rd indicates the seriousness of the situation. The four major fires which head the list which follows burned over 32,816 acres of woodland and in addition damaged or destroyed a total of 222 buildings with an estimated loss to buildings of $548,535. The damage to forest areas, measured in terms of their value as watershed protection, is $3,269,300, making a total of $3,817,835. The Las Flores Canyon fire seriously threatened the cities of Altadena and Pasadena.

Principal Fires.

| Name of Fire | Time of Origin | Size in Acres |
|---|---|---|
| Las Flores | October 23, 1:42 a.m. | 2,190 |
| Latigo (Malibu Mountains) | 3:44 a.m. | 15,297 |
| Kagel | 8:48 a.m. | 1,142 |
| Sherwood Lake (Malibu Mountains) | 11:00 a.m. | 14,187 |
| Barba | October 25, 11:30 a.m. | 23 |
| Sloan | 1:17 p.m. | 746 |
| Savage | 10:00 p.m. | 230 |
| Standard | October 27, 11:00 p.m. | 31 |
| La Brea | 5:30 p.m. | 50 |

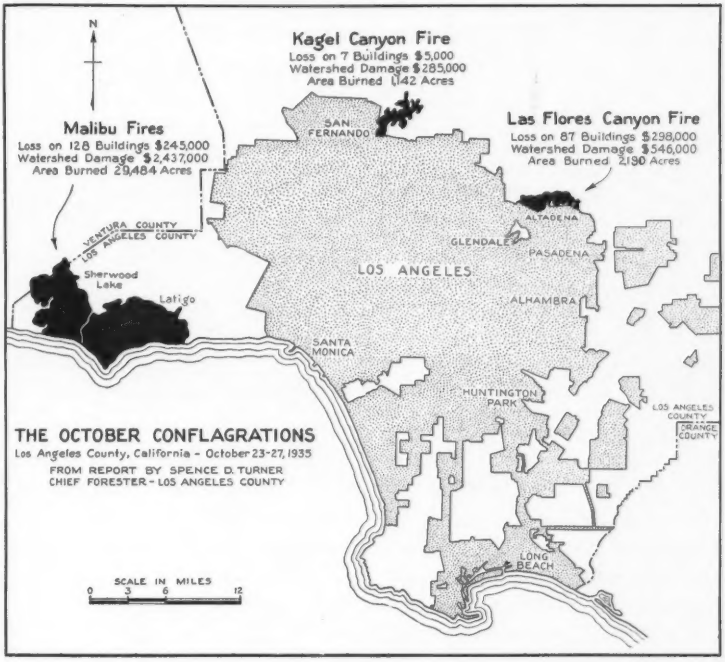
The number of acres burned over in each of the governmental units involved in the four major fires follows: Los Angeles County 29,523, Angeles National Forest 2265, Ventura County 886, City of Pasadena 69, City of Los Angeles 68, Altadena Fire District 5; total 32,816.

The County of Los Angeles and Southern California in general is a semi-arid region, with very little water in the mountainous areas. In developing fire protection facilities the local fire protection agencies adopted trucks equipped with water tanks and pumps. While primarily developed for mountainous fire control, such equipment is also essential for the protection of numerous week-end cabins and permanent residences in mountainous areas, particularly in

the Malibu Mountains along the front of the Angeles National Forest. T
effectiveness of such equipment has been reduced by the lack of adequa
water storage. Storage tanks have been erected at strategic points as far
finances permitted. Real estate subdivisions have been developed without co
sideration of fire protection and the majority do not have an adequate supp
even for domestic purposes. The lack of water makes it necessary for ta
trucks to travel many miles to refill. The following table shows the fire figl
ing forces mobilized at the four major fires.

**Fire Forces Mobilized.**

| | No. of M |
|---|---|
| **Las Flores Fire.** | |
| Department of County Forester, 5 combination engine companies, total tank capacities 2,200 gallons | 48 |
| C.C.C. and Soil Conservation Service Camps | 313 |
| Total | |
| U. S. Forest Service, regular force, 4 combinations, total capacities 1,900 gallons | 28 |
| C.C.C. Camps | 1,150 |
| Total | 1, |
| City of Pasadena—2 engine companies | |
| Total, Las Flores fire | 1, |
| **Kagel Canyon Fire.** | |
| Department of County Forester, 2 combinations, total capacities 750 gallons, 1 patrol car with 50-gallon tank | 18 |
| C.C.C. and Soil Conservation Service Camps | 91 |
| Total | |
| U. S. Forest Service, regular forces, 1 combination with 450-gallon tank, 1 combination pumper and squad car, 1 patrol car | 20 |
| C.C.C. Camps and E.R.A. | 850 |
| Total | |
| City of Los Angeles, engine company crews, 8 pieces of equipment, including 2 tractor combinations with tanks | |
| Total, Kagel Canyon fire | |
| **Malibu Fires (Sherwood Lake and Latigo).** | |
| Department of County Forester, field divisions, 11 combinations, total tank capacities 6,100 gallons, 1 patrol car with 50-gallon tank, 9 portable pumps | 187 |
| County Fire Protection Districts, 1 750 g.p.m. pumper | 11 |
| Forces from C.C.C., E.R.A. and S.C.S. camps | 1,720 |
| Total | 1, |
| U. S. Forest Service, 2 combinations with 450-gallon tanks | |
| State Division of Forestry | |
| City of Beverly Hills, 1 tank truck company | |
| Malibu Beach Colony, 1 pumper | |
| Ventura County, 1 combination with tank | 8 |
| C.C.C. and E.R.A. men | 40 |
| Total | |
| Total, Malibu fires | 2, |
| Grand total of fire forces mobilized | 4, |




## Conditions Preceding the Fires.

For several weeks preceding October 23, weather conditions had been most hazardous because of high velocity northerly winds and extremely low humidity. So critical was the situation that a week previous to the fire a stand-by order was in force and mountain stations and lookout towers were manned twenty-four hours a day. On the 20th of October conditions were more favorable and the stand-by was discontinued until the 22nd, when a strong north wind developed and the humidity fell to be approximately 20% by 9 P.M., at which time every station and tower was manned. The wind developed in intensity and by midnight velocities of from 40 to 50 miles per hour were registered and it is considered that velocities were higher at fire locations. The high velocities continued until daylight and by noon stations registered from 18 to 24 m.p.h. Throughout the Malibu Mountain fires a steady northerly wind prevailed.

## Las Flores Fire.

This fire originated well up on the side of the mountain above Las Flores Canyon in the Angeles National Forest and was discovered by the Forestry Department's San Rafael lookout tower at 1.42 A.M. At 2 A.M. weather con-

*International.*

**Ruins of the LaVina sanitarium destroyed by the fire, which started in the Las Flores Canyon in the Angeles National Forest and swept down into built-up areas. Patients in the sanitarium were removed in ambulances as the fire approached.**

ditions at this tower were: humidity 10%, temperature 58° F. The fire starte immediately adjacent to a steel tower carrying a high tension line. The look out man's attention was attracted by a bluish flame near the tower an almost immediately a blaze was detected in the chaparral cover. The origi of the fire is under investigation. The electric company admits a droppe cable due to a broken insulator pin, but denies that this had any connectio with the origin of the fire.

Due to telephone line trouble the alarm had to be relayed to the distric headquarters through another engine house. The headquarters company wit a 600-gallon tank truck responded at 1:48 A.M., followed by the Divisio Warden. The first apparatus traveled 5.7 miles and reached the fire at 2:0 A.M., followed within twenty minutes by other Assistant Wardens and fort C.C.C. men. Two engine companies from Altadena also responded promptl When fire fighters arrived, the fire had spread down the mountain to built-u areas and the first concern was saving structures. While considerable dama resulted, most of the structures, including those in the forest, were saved.

Located within the forest was the LaVina Sanitarium, housing more tha fifty patients, mostly bedridden. While all the buildings except the admini tration building were destroyed, the patients were removed without loss of li by ambulance drivers under the direction of an Assistant Fire Warden. Tw tank trucks did effective work at this location, although the wind spread t fire so fiercely that orange trees 500 feet from burning brush were kille

Wind conditions made it almost impossible to stand before blowing sand and burning material and caused more cases of eye trouble than at any previous fire. The California Forest Medical Corps and Red Cross crews gave valuable service.

At a time when it appeared that the cities of Altadena and Pasadena would be destroyed, the wind veered west. Spot fires occurred nearly a mile ahead of the main fire, increasing its size and speed of travel. The fire was brought under control by 6 P.M. by cencentrating men and apparatus, which were then released to go to the Malibu Mountain fires. Control of the Las Flores fire was greatly assisted by adjacent fire motorways recently constructed by the County Forestry Department. The total area covered by the fire was 2190 acres. There were 87 buildings destroyed with a loss of $298,671, and watershed damage* was $546,450.

### Kagel Canyon Fire.

This fire originated at 8:48 A.M. adjacent to a cabin at the foot of the San Gabriel Mountains within the Angeles National Forest. It was not possible to quickly send large crews or equipment because of the Las Flores fire. At the time the fire started the humidity was 27%, and temperature 58. The fire was determined by investigators to be the result of a drunken brawl. At 8:53 A.M. a motorcycle patrolman was dispatched, followed in two minutes by an automobile carrying fifty gallons of water. After traveling seventeen miles the patrolman arrived at 9:13 A.M. and the automobile shortly thereafter. These crews were later augmented as the Las Flores fire was controlled. Material assistance was given by the city of Los Angeles, as the fire involved territory in that city.

Many cabins were located in the area of this fire and also a large sanitarium housing many tuberculosis patients. So well were control measures carried out that no structures in County territory were destroyed and but seven in other areas. The sanitarium had in the past readily complied with fire prevention and fire protection requirements issued by the Fire Prevention Bureau of the Forestry Department, and this protection proved to be a deciding factor in saving the institution. The total area of this fire was 1142 acres. Watershed damage was $285,500. Structural loss was $5000.

### Latigo Canyon Fire, Malibu Section.

This, the most serious fire, started in brush at the top of a high bank on the inland side of the Roosevelt Coast Highway in County territory and was discovered at 3:44 A.M., although some reports set the time as early as 12:30

*While the Forest Service set the damage to watershed as $1 per acre, decision by the Association of Foresters and Fire Wardens of Southern California gives various classifications of watershed values. For the purpose of this report, considering that the watershed destroyed was of primary value, the maximum valuation has been taken.

*Acme.*

**Fire fighters saving a dwelling attacked by fire in Corral Canyon in the Malibu section. An occupant of this building was badly burned before he was rescued. The wooden shingle roof was typical of many houses in the section. Wooden shingles contributed to the destruction of numerous buildings, which otherwise might have been saved.**

A.M. Weather conditions at 4 A.M. at Malibu were: humidity 20%, tempera ture 59. The wind velocity was estimated at fifty miles per hour. Apparentl the fire originated under a 4400 volt electric line, which broke during th wind storm. The power company disclaims that such voltages could start fire, but subsequent tests with the wire in question have proved that when the broken end contacts the bark of a living shrub the latter will ignite i fifteen seconds.

Upon report of the fire a pumper and three men were dispatched from th Las Flores station and found twenty acres involved when they arrived afte a ten-mile drive. Due to the abnormal weather conditions the fire continue east and west along the ocean and aided by topographical conditions worke north against the wind. Throughout the day the efforts of the fire forces wer confined to saving buildings, as there were a great number in this area. Seve structures on the ocean side of the highway, having combustible roof cover ings and in some cases shingle sidings, were destroyed. Although during th first few hours control measures were handicapped by the inability to summo men and equipment from other divisions as had been done for the Las Flore fire, it is doubtful if this would have changed the final area of the fire. Th loss to buildings would have been reduced by additional pumping equip ment at the start. Another factor which played an important part in delayin the detection and initial attack on the fire was the lack of fire protectio

facilities in this area due to the refusal of land owners near where the fire began to sell right of ways for a lookout tower, patrol station, telephone lines, fire breaks and fire motorways. The property on which the fire started ranges along the ocean highway for over twenty miles. It was necessary in constructing fire breaks and telephone lines to dead-end them at these property lines and fire fighting was handicapped by the lack of a "tie in" of these dead-end fire roads and breaks with the main highway.

Control efforts during the night of the 23rd and on the 24th brought over half of the fire under control. Assistance from the other fire zones augmented by C.C.C. men arrived, and late on the afternoon of the 24th backfiring was begun from a motorway to save the Malibu C.C.C. camp, and later from the ocean to prevent the fire from running easterly into heavily populated areas. At daylight on the 25th, although weather conditions were still adverse, conditions on the fire line were much improved, and an intensive attack was made on the fire by both backfires and water. These efforts were almost successful when the wind "spotted" the fire over the fire fighters and also took the fire over the Mesa Peak firebreak, placing the fire on the easterly side of the main range.

### Backfiring Methods.

Backfiring in Malibu Creek Canyon was promptly adopted to bring this "slop-over" of the fire under control. While backfires may be considered desirable by laymen, they are dangerous and are only used when absolutely essential. The floor of the canyon is extremely narrow and the sides are heavily covered with broadleaf trees and shrubs and without the use of water to control the backfires the outcome would have been serious. Backfiring was immediately successful around Malibu Creek and Mesa Peak, but adverse winds made it impossible to backfire near Castro Peak until 3 P.M. on the 26th. In preparation an emergency firebreak was widened and the most elaborate layout of hose ever made in a mountain fire in Southern California was prepared to assist in the backfire work. Near the Castro Peak lookout tower was located a 5000-gallon steel water storage tank. A fleet of seven tank trucks, with an aggregate capacity of 3700 gallons, was sent up the mountain. The emergency firebreak extended 2000 feet down the south slope of Castro Peak with a drop in elevation of 500 feet and further extended 600 feet up the opposite slope to an elevation 100 feet above the valley. Along this firebreak 2600 feet of 1½-inch hose was laid and at each 400 foot interval two 150 foot lines of 1-inch hose were connected. Two pumpers were used to relay water from the 5000-gallon tank to the main line of hose, and tank trucks were assigned to keeping the tank full. This necessitated a drive of two miles down the mountain for each load. With this hose line and firebreak it was possible to backfire along the firebreak and keep the fire under control. On a number of occasions fire carried across the firebreak and only strenuous efforts

with hose lines held it in check. The total length of backfiring at this fire wa 16.7 miles. The fire burned over 15,297 acres, causing $1,229,860 damage t watersheds, and ninety-nine buildings were involved with a loss of $234,175.

### Sherwood Lake Fire, Malibu Section.

This fire started in Ventura County in an isolated canyon at approxi mately 11 A.M. on the 23rd. It is believed that a resident started the fire t increase the forage for his live stock. A lookout observer discovered the fir but could not notify the Malibu headquarters until 11:12 A.M., due to troubl with telephone lines in the fifty-mile wind. Only one man was available at th start to go to this fire from Los Angeles County. When he arrived 100 acre were burning. Ventura County equipment prevented the further spread i their territory, but the fire continued to spread until it finally merged with th Latigo fire at Malibu. This fire covered 14,187 acres, causing $1,207,49 watershed damage. Twenty-nine buildings were destroyed with a loss o $10,689.

## Fatal Oil Heater Fire, West Orange, N. J

By R. M. Cadman (Member N.F.P.A.),
Schedule Rating Office of New Jersey.

Four boys, ranging in age from five to fourteen years, were suffocated b a fire in an attic bedroom of their home in West Orange, N. J., on the night o November 21, 1935. The fire, which was caused by a portable oil heater place too near a combustible partition, was confined to the room, with property dam age estimated at only $60. The death of the boys, the sons of Mr. and Mr James Ciampi, was attributable to leaving the heater burning when the boy went to sleep and to the use of flimsy packing box materials in constructin the room, which caused the fire to spread so rapidly that escape or rescue wa impossible.

The fire started in a bedroom partitioned off in the attic, evidently fro a garage type oil burning unit heater without flue connection, which was s too close to a partition. Firemen found the oil burner overturned, but it believed that it was overturned by the force of hose streams. The fire not considered due to improper operation of the burner, although newspape reports indicated that the heater was not in proper operative condition. Mo of the partitions in the room were made of three-ply veneer packing case mat rial which was highly combustible. Mr. Ciampi is said to have admitte erecting the partitions recently without obtaining a building permit. Part the ceiling and one wall were made of soft pressed fibre board about ½-inc thick. The remainder of the ceiling was covered with corrugated iron whic

caused flames to mushroom and prevented escape of smoke. Firemen believe this caused the quick suffocation of all four boys who were subsequently burned.

Mrs. Ciampi and two daughters were retiring to their first floor bedroom when they smelled smoke and heard one of the boys call. The mother tried to climb the narrow stairs leading to the second floor bedroom, but was driven back by dense smoke. The father of the boys who was across the street was called and with the help of some neighbors tried to enter the room through a window, but was unable to do so because of the smoke. Not until firemen attacked the flames with hose streams could the room be entered. One fireman was badly injured from inhaling flame and smoke. Two of the boys had collapsed on the floor and the other two were still in one of the two beds. The fire was confined to the room and was quickly extinguished.

*Newark Evening News.*

**Left: Rear of the house in West Orange, N. J., in which fire occurring in an attic bedroom suffocated four boys. The fatal fire was confined to one room. Right: The garage type oil heater which ignited combustible partitions in the attic bedroom.**

# Air Conditioning and Ventilating Fires.

The increased use of air conditioning systems serves to call attention to the possible fire hazards connected with these systems as well as the hazards of heating and ventilating ducts in general. Several severe fires involving modern air conditioning systems illustrate the necessity of eliminating all combustible linings from ducts and show the serious results of fires spreading through ducts due to drafts from blower fans connected with the system. The possibility of fire or smoke from outside sources being drawn into the system should also receive consideration. This record includes only fires in air conditioning systems and other ventilating systems and does not include fires in blower systems designed for removal of dust, fumes or refuse in connection with industrial operations.

Air conditioning systems differ from the ordinary system of heating and ventilating ducts in that they are generally equipped with cooling coils or apparatus, filters or water sprays for washing the air, and operate under positive mechanical draft provided by fans, although fans are also employed in some of the ordinary ventilating systems which do not include equipment for conditioning the air. The ducts of air conditioning systems are usually lined with insulating material to eliminate any noise which might result from the normal operation of the equipment and to prevent change of temperature of the conditioned air.

## Air Conditioning System Fires.

The following serious fires have been reported to the N.F.P.A. Department of Fire Record in which air conditioning systems have been involved. Each fire serves to illustrate typical hazards which should be guarded against.

### Lido Theatre Fire.

The first of these fires occurred in the Lido Theatre at Maywood, Ill., on January 1, 1933. This fire shows the importance of promptly shutting down forced draft ventilating equipment when a fire is discovered. In this instance the draft from the air conditioning system spread the fire to the balcony and to the foyer in the rear of the balcony of the theatre. In addition, the drawing of smoke to those sections by the equipment greatly hindered fire fighting operations.

The theatre was of fire-resistive construction and had a seating capacity of 1835. It was originally designed solely for presentation of motion pictures but at the time of the fire acts of vaudeville were included in performances. With the advent of sound pictures a larger screen was installed about four feet

in front of the former screen and loud speakers were located between the screens. In addition this space was used for the storage of scenery and stage rugs. The stage was not equipped with a vent or sprinklers, nor was the stage separated from the theatre proper by means of a proscenium wall or standard fire curtain. A canopy over the stage and several scenery wings were supported by woodwork.

The theatre was equipped with a combination cooling and heating system. A masonry-enclosed fresh-air shaft extended from the basement to a point above the roof of the theatre. Fresh air, drawn through this shaft over a series of steam coils during cold weather, and refrigerator coils during hot weather, was blown through a system of ducts by a large motor driven fan. The ducts terminated in grilles in the side walls of the theatre and in the rear wall above the balcony. There was also a foul air exhaust system, but it was not in operation when the fire occurred.

The fire originated on the stage near the performers' dressing room from an unknown cause. The afternoon performance had not started, but a number of children were in the auditorium when an employee discovered the fire. The fire spread rapidly, involving curtains on both sides of the screen, the canopy above the stage and combustible material in the wings. Dense smoke filled the entire theatre. The fire department was handicapped by a delayed telephone alarm and insufficient manpower. The air conditioning system was in operation until five or ten minutes after the fire department arrived. The continued operation of this system fanned the fire to greater intensity, particularly in the balcony, where brands had ignited the seats. The foyer stairway leading to the balcony and space above was so filled with smoke that it was inaccessible, and in order to reach and extinguish the burning balcony seats it was necessary to raise a ladder from the main floor to the balcony. The scenery and equipment on the stage were destroyed. All seats in the balcony and auditorium were damaged and considerable damage was done to the balcony foyer, the doors leading to the balcony and the curtains over the doors. (H-36299.)

### Higgins Building Fire.

A second fire involving an air conditioning system occurred in the Higgins Building, an office structure in Los Angeles, Calif., on September 12, 1934. This fire showed that a smouldering fire involving combustible duct linings, even if of slow burning material, may be fanned into a serious fire when the fans are placed in operation.

The building was ten stories high, of reinforced concrete construction. A new air conditioning system had been installed for all office tenants, but did not serve stores on the first floor. The system consisted of two independently operated units, one serving the north and east sides and the other the south and west sides of the building.

Air was drawn from the corridors of each floor into intake ducts extending to the roof from which fans sent air through spray type humidifiers and coolers to blowers which delivered the reconditioned air through thirteen return ducts to the nine floors receiving the service. These ducts extended down from the tenth to the second floor and supplied each room through a six by sixteen inch duct. Used air escaped through louvers in the doors of each room into the hall where the air returned to the roof through the intake ducts.

Suspended below the concrete slab roof was the metal lath and plaster ceiling of the tenth floor. Applied on the plaster above about one-half of the tenth floor was a combustible sound-deadener. The attic space above the top floor was occupied by service piping and by fibre-lined metal ducts which delivered air from a humidifier on the roof to the down draft ducts of the building.

More than 9000 square feet of wood fibre was used in lining the ducts. The lining did not extend below the ceiling of the tenth floor and was used for sound insulation exclusively. The insulation used was a wood fibre which if ignited under ordinary conditions, only smoulders. It is said to give off a flammable gas at 175° F. and to ignite at 250° F. In a draft it flares up with more complete combustion.

The origin of the fire is not definitely known. No repair work had been done on the blower system for four days, but workmen had been making some alterations on the hot water system the night preceding the fire and had left some tools, a blow torch and some rubbish, in the attic space. An electrical extension cord with burned insulation was also found in this space, but the fuse had not burned out and the cord was not in contact with any combustible duct lining. However, regardless of the cause of the fire, if the duct lining had not been of combustible material, the fire could not have smouldered for several hours and then flared up when the fans were operated.

The fire occurred at 6:15 A.M. The building engineer had been to the roof about 5:50 A.M. and after his usual inspection started the fans operating the air conditioning system. As he walked to the basement he smelled smoke and went to the engine room to investigate. As there was no evidence of trouble there, he went outside and saw smoke pouring from the top floors. Telling a scrub-woman to call the fire department, he hurried to the roof to turn off the fans of the air system. As soon as the fans stopped, the entire air conditioning system appeared to burst into flames. The combustible lining of the intake and outlet compartments of the ducts was completely consumed. Apparently the intake fan was drawing this flaming material through the system into the reconditioned air outlet ducts and thence into the rooms, especially those on the tenth floor. Because the fire was in an enclosed duct it was inaccessible, resulting in a very large amount of smoke and water damage. Additional heavy water damage was caused by the bursting of one of the four

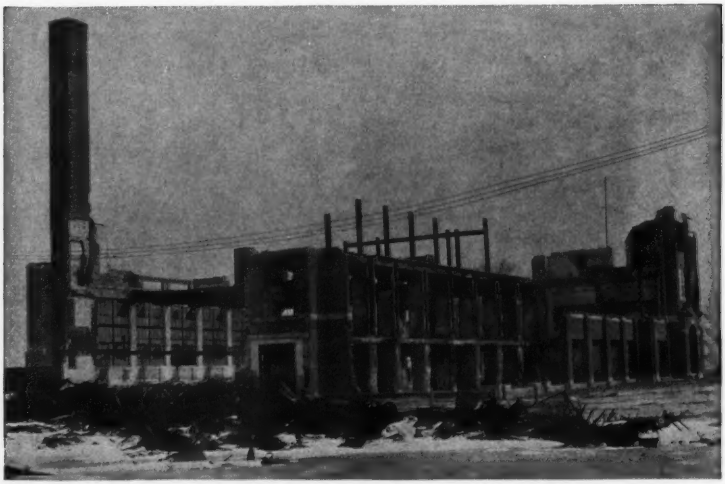
**Vertical openings including ventilating ducts were responsible for the rapid spread of this fire to the roof space of the Lynn, Mass., High School. Fifteen pumping engines backed up by plenty of water were unable to prevent the total destruction of the main building.**

building standpipes on the sixth floor. The fire department did not attempt to use the other standpipes after the failure of the first standpipe and resorted to the use of a water tower. This hampered the fighting of the fire. The loss approximated $50,000. (H-38928.)

### Strand Theatre Fire.

The fire which damaged the Strand Theatre in New York City on December 14, 1934, was the most serious fire reported in which an air conditioning system was involved. This fire is of particular interest because of its peculiar origin, involving the use of flammable insulating material within the air conditioning system of the theatre. Originating entirely outside of the building, it extended to the interior of the auditorium section, where the damage was heavy.

The theatre was of fire-resistive construction, having a seating capacity of 3350 and was provided with an air conditioning system supplying cold air to the auditorium. The refrigerating machinery was located in the basement of an adjacent building and cold air was forced by a blower in the basement of this building through a sheet metal duct. This duct emerged through the pavement of a fifteen foot wide exit court between the theatre and the other building, extended across the court to the north wall of the theatre and



**The Lincoln Consolidated School near Ypsilanti, Mich., was destroyed by a fire thought to have been caused by a match or cigarette thrown into a ventilating duct in the gymnasium. The fire spread up a ventilating shaft to the roof. The school was destroyed with a $200,000 loss.**

extended along this wall and also the east wall. Where the duct emerged into the court it was seven by four feet in size and maintained these dimensions for eighty feet. It eventually reduced in size to about two by two feet and had a total length of 160 feet. Small branch ducts extended from the large duct through the building wall and discharged through ventilating openings in the auditorium section. The entire interior of the duct on the outside of the building was lined with a flammable insulating material, consisting of one layer of ordinary pressed wallboard. The loss to the theatre can be directly attributed to the existence of this flammable insulating lining.

At approximately 5 P.M. a considerable quantity of rubbish in the court began to burn, but was extinguished by the building engineer and other men with buckets of water. This rubbish was piled against the air conditioning duct. Smoke was noticed in the theatre soon after the fire in the rubbish in the court was extinguished, but it was thought due to the rubbish fire and no attention was paid to it. The smoke increased and the audience numbering under 200 persons was asked to leave. This they did without confusion. Two motion picture operators, however, being at the high point in the auditorium, were subjected to the greatest heat and were forced to escape through a window from which they slid down a telephone cable to the ground. An alarm was sent to the fire department at 6:56 P.M. and due to difficulty in locating the source of the fire a second alarm was transmitted.

Examination showed that the rubbish fire in the court had caused the flammable insulating material in the air duct to ignite. The duct was built of light sheet metal on angle iron frame. Ignition of the lining may have been due to conduction of heat through the sheet metal or by direct communication through small openings at seams. Fortunately, the air conditioning system was not in use at the time, as it probably would have intensified the fire and driven it into the auditorium sooner, possibly resulting in a panic. The flammable insulating material apparently smouldered for some time, but eventually all of this material ignited. Smoke and hot gases were discharged into the auditorium through numerous duct openings, igniting balcony seats and furnishings and scorching and blistering the wall and ceiling finish. The ceiling of the auditorium was considerably damaged. Building damage was estimated at $57,000 and loss to contents was $5000. Had the ducts been constructed of brick or hollow tile without combustible linings and with automatic dampers this loss would not have occurred. (H-38963.)

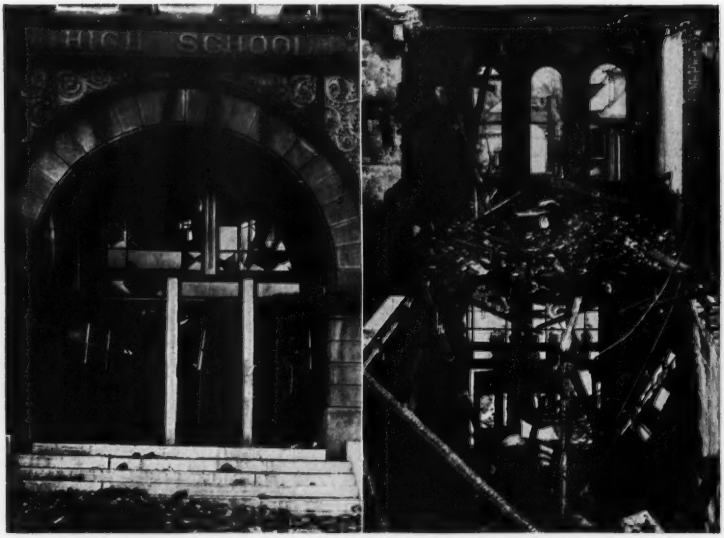
## Heating and Ventilating Ducts.

Ducts of ventilating and heating systems have been responsible for numerous fires spreading from a comparatively insignificant origin to cause serious loss or even total destruction of the buildings in which they were employed. These systems are quite generally used in schools and other buildings in order to provide continuous circulation of air at a given temperature without the discomfort of cold drafts and waste of heat, resulting when fresh air is brought directly inside through windows. Probably the most general arrangement has utilized a double system of ducts connected to each room. The air freshly heated is delivered through a register near the floor and foul air is eliminated through a register near the ceiling connected to ducts which quite frequently discharge into an open attic over the building. An arrangement by which the ducts discharge into an open attic is a very serious defect, as fires have frequently gained great headway in the attic space before being discovered, destroying the attic and roof. Embers often drop down ducts and start fires in other rooms. The following fires are typical of those in which ducts discharged into open attic spaces rather than directly to the outside or some other safe location.

### Fires Involving Attic Spaces.

MARCH 29, 1924. HIGH SCHOOL, RICHMOND, IND.

Fire occurred at 3:00 A.M. in the waste paper room in the basement of the Garfield Annex, due to spontaneous ignition. The building was of two-story, brick-joisted construction with a slate roof, and adjoined a new three-story fire-resistive building. The fire showed the hazard of ventilating ducts in spreading fire, particularly those which are not cut off from the basement and terminate in an open attic space. Although the fire originated in the base-




**The Richmond, Indiana, High School fire. Left: Front entrance of building indicating general appearance of exterior construction. Right: Ruins of the annex. Fire started in basement, but spread rapidly to the attic through ventilating ducts, the principal damage being to the upper parts of the building.**

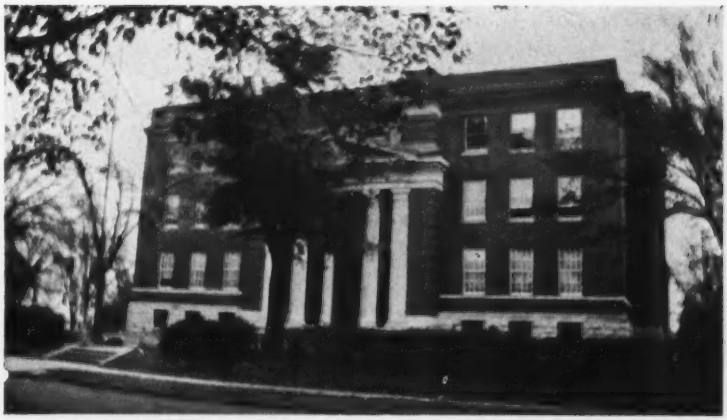
ment, the greatest damage was done on the second floor and roof, to which the fire spread by way of metal ventilating ducts. About half of the first floor of the annex and the new main building were saved. The loss was estimated at $150,000. (See July 1924 QUARTERLY, page 95.) (H-20865.)

DECEMBER 23, 1926. JEFFERSON DAVIS SCHOOL, LEXINGTON, KY.

Fire due to spontaneous ignition in the basement was discovered at 3:15 A.M. The blaze spread through the ventilating system, which opened into the roof space of the brick-joisted building. A loss of $82,500 resulted. (H-24066.)

JANUARY 9, 1927. BOLTWOOD INTERMEDIATE SCHOOL, EVANSTON, ILL.

Fire of unknown origin was discovered in the manual training room in the basement at 2:02 P.M. The building was of brick-joisted construction, two stories in height. Unprotected air shafts extended from the basement to a large open attic over the entire building. The fire had considerable headway when the fire department arrived. Hose lines were taken inside and the fire in the basement practically brought under control, but the fire had already traveled up an unprotected air shaft and involved the large open attic. As the roof and top floor showed signs of collapse, hose lines were withdrawn and the fire was fought from the outside with the assistance of eleven fire companies



**The Little Rock High School, partially destroyed by fire on Nov. 10, 1932. The value of partial fire-resistive construction was largely offset by a wooden roof and a system of ventilating ducts that spread fire throughout the building.**

from Chicago. With the exception of the boiler house, the building was practically a total loss. (H-24104.)

JANUARY 28, 1929. HARRISON SCHOOL, CEDAR RAPIDS, IOWA.

Fire originated in the basement from an unknown cause at 2:02 A.M. Ventilating shafts of brick and metal construction terminated in the attic and contributed materially to the spread of the fire, which destroyed the two-story brick-joisted building. The loss amounted to $131,650. (H-27165.)

APRIL 4, 1931. HIGH AND GRADE SCHOOL, MAYSVILLE, MO.

The building was one and two stories high of joisted construction with walls of tile covered with brick veneer. Fire occurred from defective wiring in the ceiling of the first floor at 1:30 P.M. It spread rapidly to other parts of the building by means of metal ventilating shafts which opened directly into the blind attic. The loss was nearly total and amounted to $85,340. (H-31240.)

NOVEMBER 10, 1932. EAST SIDE JUNIOR HIGH SCHOOL, LITTLE ROCK, ARK.

Fire occurred in a three-story partly fire-resistive building having brick exterior walls, metal lath and plaster partitions, and concrete floors. The roof was of wood covered with built-up composition, tar and gravel. Floors were supported in part by unprotected cast iron columns and in part by reinforced concrete columns. The ceiling of the top floor was metal lath and plaster on metal joists. Between this ceiling and the wooden roof was a three-foot blind attic. In older portions of the building the roof was supported by wooden trusses and in the new section by unprotected steel trusses. The building was heated by a hot air system and each room in addition to a hot air duct had

an independent metal ventilator duct that terminated at the ceiling line in the attic. These ducts were built side by side and in places there was a continuous area of ducts twelve feet long.

The fire was discovered in the office on the first floor and was probably caused by an overheated furnace, as the temperature was low and the furnace was being forced to heat the building for an evening meeting. The fire had considerable headway when discovered and was burning in two rooms on the first floor. Shortly after the fire department arrived, fire was discovered in the attic space. Burning embers dropped down the ventilating shafts, starting fires in various rooms. Two-thirds of the roof was burned off. The loss was estimated at $40,000 to $50,000. (See January 1933 QUARTERLY, page 247.) (H-36102.)

### False Ceilings and Blind Spaces.

In some installations the hazards of inaccessible open spaces are not confined to attic or roof areas, but are created by having vertical shafts or ducts discharge into or pass through open spaces created by means of false ceilings or floors. Such an arrangement greatly increases the likelihood of severe fire losses, as fire can spread through such an area practically unrestricted.

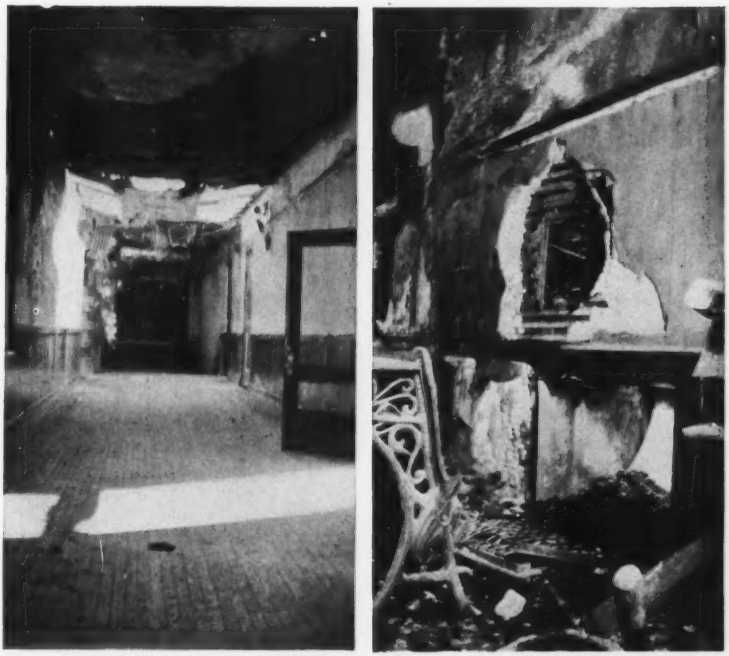
JANUARY 11, 1920. PUBLIC SCHOOL No. 110, BALTIMORE, MD.

Fire started in the furnace room in the basement caused by hot ashes deposited in a metal container on a wooden platform. The building was of brick-joisted construction. The principal structural features responsible for the rapid spread of the fire were the enclosed rear stair well and the ventilating ducts in each first and second floor corridor which opened into the stair well. These ducts, about 6 ft. high, were formed by false ceilings of lath and plaster and sheathing. The ventilating ducts were connected with classrooms by ordinary cast iron registers.

The fire was discovered at 6:18 P.M. in the basement adjacent to the enclosed stair well and spread rapidly upward by way of the stair well and into the corridor ventilating space and up into the large blind attic. The fire was confined to these areas but was very difficult to extinguish. Considerable loss resulted. (H-16524.)

SEPTEMBER 8, 1932. GARRICK THEATRE, CHICAGO, ILL.

Fire occurred in a theatre occupying the lower portion of a seventeen-story fire-resistive office building. The theatre had a seating capacity of about 1400. The stage sections were equipped with sprinkler and standpipe systems, but these systems were not a factor in this fire. There were two concealed spaces beneath the auditorium floor, largely of combustible construction. Leading to the upper space were floor registers for ventilation. These were not piped and any material entering a register would drop to the wooden deck below, presenting a severe fire hazard.



**Left: Looking along a third floor corridor of the Little Rock High School; open stairway in the background. Note failure of metal lath and plaster ceiling below the blind attic. Right: Bottom opening of one of the ventilating ducts, through which fire spread from the blind attic.**

Fire occurred during an evening performance while an audience of 465 persons, mostly men, were watching a vaudeville show. A man in the audience saw smoke coming through a floor register and notified an employee. An attempt was made to extinguish the fire through the register, but this was not successful. Efforts were then made to reach the fire from beneath the auditorium. As the fire had already started to spread, the audience was asked to leave. The fire department was then called. The fire department responded to two alarms and attacked the fire from all available places beneath the auditorium. The ventilators over the stage were opened, allowing smoke and heat to escape. A large ventilating fan in the basement was stopped to prevent it from drawing the fire to other sections. The cause of the fire is unknown, but was probably due to smoking. The floor and seats in the auditorium and the underfloor space were damaged. Smoke and water damage also resulted in other portions of the theatre. (S-62905.)

**Ruins of Western High School, Detroit, showing ice-covered walls, all that remained after a fire of apparently incendiary origin swept the building. Ventilating ducts which honeycombed the building spread the fire to all parts of the structure.**

FEBRUARY 25, 1935. WESTERN HIGH SCHOOL, DETROIT, MICH.

The main building was of brick-joisted construction two and three stories in height. When the school was built, a three-foot space was left between the ceilings and floors above for ventilating ducts. Ducts were also installed in vertical partitions. This type of construction contributed materially to the spread of the fire.

The fire, which was of incendiary origin, was discovered on the first floor by the night janitor who was endeavoring to locate the source of smoke. He ran down the stairway to the basement and out through the rear of the building to his home, about one block from the school, from which he called the fire department by telephone. This call was received at 11:52 P.M. A city fire alarm box inside the building within fifteen feet of where the janitor was standing when he discovered the fire was forgotten in the janitor's excitement.

The first engine company to arrive entered the building with a chemical line and first aid equipment, as there was no evidence of fire from the outside. They extinguished the blaze at the end of the row of lockers and discovered, meanwhile, another fire burning beneath a teacher's desk in a near-by classroom. While this latter incipient fire was being extinguished, two more similar fires were discovered under teachers' desks in adjoining classrooms. Another

fire was then discovered at the far end of the corridor in a classroom at the extreme southeast corner of the building. This fire had apparently gained access to the ventilating ducts and had spread to the attic. Five alarms were sounded, but the fire spread rapidly and practically destroyed the building. The loss was $582,702. (See April 1935 QUARTERLY, page 329.) (H-39753.)

### Blower Fans Spread Fire.

The following fires illustrate how rapidly a fire may spread where fans are in operation. Fortunately no lives were lost in these fires.

DECEMBER 27, 1918. AMERICAN AVE. GRAMMAR SCHOOL, LONG BEACH, CALIF.

A defective heating system was responsible for a fire which started in the basement of this 2-story frame, brick-veneer building while 600 pupils were attending classes. The alarm was promptly sounded and the building was vacated in two minutes. The flames which filled the furnace room were communicated to all parts of the building by a motor driven fan provided to force the hot air through the pipes of the heating system. When the fire department arrived the fire had spread to all floors, and was coming through the roof. The loss, $44,086, was practically total. (H-15275.)

MARCH 3, 1934. WYANDOTTE HIGH SCHOOL, KANSAS CITY, KANS.

The building was of three-story, brick-joisted construction with corridor walls of brick and stone. There was a common roof space over the entire building. Six open stairways extended from the basement to the third floor. The heating and ventilating equipment was a hot blast indirect heating system, with distribution through galvanized iron ducts and brick stacks. Fresh air intakes for the center section were from openings in the front of the building extending to the fans by tunnels beneath the basement floor. Air intake for the north and south wings was through ducts in the concrete ceiling over fan and ventilating rooms. The foul air system for the center section was down-draft to brick, wood top tunnels three feet high under the basement corridors discharging by fans into brick stacks at the rear. These corridors were from eight to twelve feet in width. The tunnels beneath had brick and stone side walls, and the corridor floors above, of wooden sheathing on wooden joists, formed their ceiling. There was three inches of concrete without reinforcement over the sheathing. Two brick stacks in the auditorium ended in the attic, with tops closed by heavy wooden traps. The foul air systems for the wings exhausted through roof vents. Steam for the heating coils was supplied by oil fired boilers in the center section.

The fire was first noticed in the basement corridor in a pasteboard box containing waste paper. The night engineer and janitor thought that they had extinguished the rubbish fire, but a few minutes later smelled smoke and called the fire department at 4:45 P.M. When the firemen arrived there was a little

smoke but no fire visible. They chopped the baseboard and some of the lath and plaster away from the partition at the point where the waste paper box fire had occurred, but found no fire. Back of the baseboard there was a small hole in the floor, opening into a space formed by the brick wall, floor joist and two headers over the tunnel. The underside of the flooring was considerably burned. The fire was next noticed through the glass panel door of the foul air fan room. By this time the smoke was quite dense and men were sent to upper floors to ventilate. They returned and reported fire in various rooms on upper floors. The firemen were then ordered from the building. Before they could get out, part of the floor in the main basement corridor over the tunnel collapsed, nearly trapping several men. When the ventilating fans were shut down, the fire traveled in both directions through air tunnels, discharging through the foul air registers into rooms and halls of the center section. A wooden stairway extending from the basement directly over the fan room to the top floor allowed the fire to spread rapidly into the attic. Fire spread down from the attic into the auditorium through foul air ducts. The attic, roof, third floor, and auditorium were destroyed. During the fire eleven engine companies were in action, including two from Kansas City, Mo. The loss was $265,809. (H-37804.)

### Ducts of Combustible Construction.

The danger of heating and ventilating systems contributing to the spread of fire has been materially increased in some cases by constructing ventilating ducts of wood. The wooden ducts, thoroughly dried by the hot air, carry fire through inaccessible wall and floor spaces, making it practically impossible to control. The three following fires in which schools were destroyed show the result of this type of construction. Fortunately classes were not in session.

JANUARY 15, 1919. HIGH SCHOOL, MCALESTER, OKLA.

Fire of unknown origin was discovered at 3:45 A.M. in the basement of the brick and stone-joisted building. Fire spread by means of a wooden flue ventilating system which extended from the basement to all parts of the building. The loss was estimated at $91,000. (H-14918.)

OCTOBER 13, 1923. PUBLIC SCHOOL, FREEMAN, S. D.

Fire started from an undetermined cause at 4:30 P.M. while a few children and teachers were in the building. The building was a two-story frame structure of six rooms. The fire started in the basement of the ventilating shaft of wooden construction and spread through the building by means of the shaft. When the fire department arrived, the structure was filled with smoke and it was difficult to locate the fire. The school was destroyed. (H-20017.)

JANUARY 4, 1927. HIGH SCHOOL, CHARLESTON, ILL.

Fire due to defective wiring originated in the basement of the brick-joisted building at 9:30 P.M. When the fire department arrived the firemen

could not locate the fire at first, but finally found it working up from the basement through wood lined ventilators. The fire went from the basement to the roof by way of these ventilators and then burned down. The loss was $101,000. (H-24144.)

### Rubbish in Vent Ducts.

Where poor housekeeping prevails vent ducts are apt to become receptacles for rubbish or dust which may provide fuel for a chance spark entering the ducts. Even when fire does not originate in the rubbish deposited in the vent ducts it may ignite from the heat and sparks from a fire starting elsewhere in the building and cause the fire to spread through the ventilating system. The following fires show what may be expected when ducts are not kept clean or are allowed to deteriorate.

JANUARY 31, 1930. PUBLIC SCHOOL, PERRY, ILL.

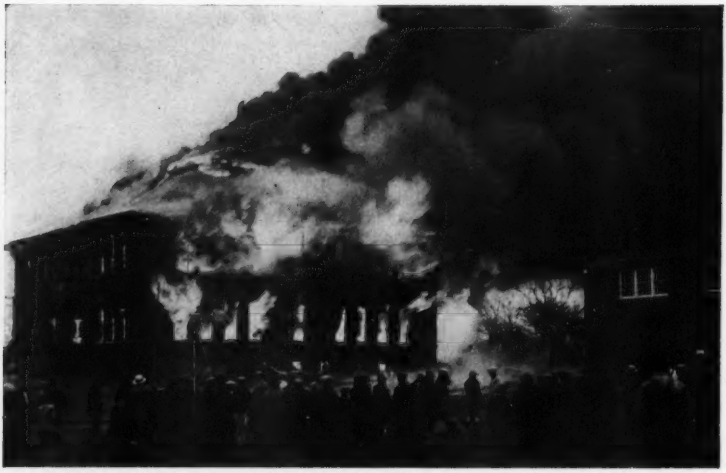
Fire started on the first floor of the two and one-half story brick-joisted school building at midnight. Sparks from the chimney were blown into the ventilating shaft which was connected to each room. It is thought that a considerable amount of dust and rubbish had accumulated at the bottom of the shaft, which ignited and caused the fire to spread quickly to all rooms. Inadequate fire protection facilities made efforts to save the building fruitless. The loss was $50,300. (H-29702.)

MARCH 6, 1931. PUBLIC SCHOOL, HARRAH, OKLA.

Fire started in the basement of the two-story, brick-joisted building. The heating system was being forced due to cold weather. The hot air was distributed by insulated metal ducts to registers in the floors of all rooms and in the halls. Smoke was noticed soon after children entered the school, but at first caused little concern as papers frequently fell into the registers and smouldered. Soon, however, a teacher noticed flames in a register, dismissed her room and sounded an alarm. There were about 200 children on the second floor, most of whom used a slide escape. A few came down the stairs. The building was emptied in a little over one minute. The last to leave said that the floors were hot and the smoke choking. The fire spread so rapidly that practically nothing was saved. The fire started in the heating system. It is not known whether deterioration of the metal ducts or ignition of rubbish in the registers caused the fire, but it is obvious that the rubbish condition was so prevalent that little attention was given to the first signs of smoke. The loss was $40,000. (H-31237.)

### Fire or Smoke From Outside Sources.

The danger of sparks or fire from outside sources has been mentioned in connection with the air conditioning system fire in the Strand Theatre in New York City, and also the fire which destroyed the public school at Perry, Ill., on January 31, 1930. The danger of exposure fires entering ducts makes the



**The fire which destroyed the Harrah, Okla., primary school building started while approximately four hundred children were in the building. The blaze started in hot air registers and little attention was paid to first signs of smoke, as rubbish smouldering in the ducts was a usual occurrence. The fire spread rapidly to all parts of the building, but all children escaped due to well-conducted fire drills and use of escape facilities.**

following fires of special interest. The possibility of serious consequences when smoke from an exposure fire enters a ventilating system is also shown.

MARCH 12, 1920. PUBLIC SCHOOL, WALNUT SPRINGS, TEX.

Fire attributed to careless smoking occurred in a pile of kindling wood outside of the two-story, brick-joisted building. The wind carried sparks and flames into a ventilator opening, igniting the first floor of the building. The building was destroyed with a loss of $40,000. (H-16265.)

JANUARY 12, 1927. AUDUBON THEATRE, NEW YORK, N. Y.

The property involved in this fire consisted of a fire-resistive theatre separated by a twelve-inch brick wall from a two-story brick-joisted building occupied by a store and a ballroom. The fire started in the basement of the mercantile building and reached three-alarm proportions. A vent duct thirty inches square from the ladies' room in the theatre passed through the wall of the theatre and discharged through the roof of the store and ballroom section, providing an almost direct path for smoke to enter the theatre. The exhaust fan in this duct was not running and the inward draft brought smoke into the building in large quantities. This duct, together with the main vents of the theatre which were so located that smoke was drawn into them, injected such a volume of smoke into the theatre that the audience was forced to make a hasty exit. Fortunately the theatre was not crowded and no panic resulted. (H-24106.)

# Loss of Life by Fire, 1930-1935.

Safeguarding life against fire is the first object of fire prevention and fire protection. Loss of life by fire in the United States is estimated at more than 10,000 annually.

Since October 1930 each issue of the QUARTERLY has contained a summary of all reports of fires involving loss of life which have been received by the N.F.P.A. Department of Fire Record during the previous quarter. The reports received include those contributed by interested N.F.P.A. members. These summaries, while representing only a fraction of the fires which occur, cover a sufficiently broad base of experience to permit drawing conclusions as to the conditions under which loss of life by fire has occurred, and to show how such casualties may be avoided by proper measures of fire prevention and fire protection. It is probable that the number of these loss of life fires reported to the N.F.P.A. represents only about 15 per cent of the fire deaths occurring annually in the United States. The present tabulation brings up to date the cumulative record of loss of life by fire first published in the October 1933 QUARTERLY. This record includes data from twenty-two QUARTERLY tabulations and covers 3614 fires in which 6628 fatalities occurred during the period from June 20, 1930, to December 18, 1935.

It is believed that the total number of fire casualties in the United States is now substantially less than formerly. The present estimate of 10,000 lives annually compares with an estimate of 15,000 commonly quoted prior to 1920. Until recently the death registration area did not include the entire continental United States, so the Census figures had to be modified to give an estimate for the entire country. On this basis the Census Bureau returns for the 1922-1929 period showed an average of 7125 deaths annually, due to "Conflagrations" and "Burns" (excluding scalds and molten metal). The present N.F.P.A. analysis shows that one-third of the fatalities were due to causes which were presumably included in the Census mortality statistics under other classifications. For example, deaths by drowning when persons jump from a burning boat or deaths due to accidents while fire apparatus was responding to alarms of fire are classified by the N.F.P.A. as fire casualties because the loss of life would not have occurred if there had been no fire. On the basis of the above estimate the average annual loss of life by fire in the United States was 10,687 for the period 1922-1929 inclusive.

Since 1929 the U. S. Census compilations have been modified to include some of the deaths due to fire which were previously classified under other headings. On the new basis the U. S. Census totals for the years 1930, 1931

and 1932 are as follows: 1930, 8515; 1931, 7390; 1932, 7474. Insufficient information is available to permit satisfactory comparison of these figures with those previously published, but it seems clear that the totals are still substantially less than the number of deaths on the N.F.P.A. basis of classification, which includes all deaths which would not have occurred if there had been no fire.

According to statistics furnished by the Dominion Fire Commissioner loss of life by fire in Canada for the ten-year period 1925 to 1934 inclusive averaged 302 persons each year. Of the total fatalities for the ten-year period 51.9 per cent were children and 27.6 per cent were women. It is probable that the Canadian figures do not include deaths due to response to alarms and other indirect fatalities considered by the N.F.P.A. as fire deaths.

**Fatalities by Age and Sex.**
U. S. Census Bureau.

| | 1929 | 1930 | 1931 | 1932 | Total 1929-1932 | % |
|---|---|---|---|---|---|---|
| Men ..... | 2,323 | 3,092 | 2,337 | 2,530 | 10,282 | 33.5 |
| Women ..... | 1,969 | 1,988 | 1,816 | 2,002 | 7,775 | 25.2 |
| Children under 15 yrs. | 3,478 | 3,341 | 3,128 | 2,797 | 12,744 | 41.3 |
| Total..... | 7,770† | 8,421† | 7,281 | 7,329 | 30,801 | |

Table 1 of the present record shows the distribution of fatalities between men, women and children. More than half of the victims of the fires in this record were men. U. S. Census statistics indicate that about one-third of all fire fatalities are to men. The preponderance of men as fire victims in this record is explained by the fact that the N.F.P.A. fire record files are more complete for fires in industrial properties than for fires in residential occupancies. Men were the principal victims in fires in mining property, airplanes, automobiles and a number of other occupancies as well as in fire fighting operations.

**Table 1. Age and Sex of Victims by Occupancy Classification.**

| Age and Sex of Victims | | | OCCUPANCY CLASSIFICATION | | | | | | | | | | No Data* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Dwellings, Apts., etc. | | Buildings other than Dwellings | | Outside of Buildings | | Response to Alarms | | | | |
| | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | No. | Per Cent | | | |
| Men .....3527 | | 53.1 | 1013 | 29.1 | 765 | 76.4 | 1617 | 80.7 | 91 | 93.9 | | | 41 |
| Women ...1319 | | 19.9 | 1007 | 29.0 | 116 | 11.7 | 190 | 9.5 | 4 | 4.1 | | | 2 |
| Children ..1734 | | 26.2 | 1430 | 41.1 | 108 | 10.9 | 188 | 9.4 | 2 | 2.0 | | | 6 |
| No data.... 48 | | .8 | 27 | .8 | 10 | 1.0 | 11 | .4 | 0 | .0 | | | 0 |
| Total.....6628 | | 100.0 | 3477 | 100.0 | 999 | 100.0 | 2006 | 100.0 | 97 | 100.0 | | | 49 |
| Percentage distribution of fatalities between various classifications. | | | 52.4 | | 15.2 | | 30.3 | | 1.5 | | | | .6 |

*Includes cases where data are insufficient to show occupancy, class of building, or whether fatality occurred in or outside building.

†There are minor discrepancies between these figures and other Census Bureau figures for the same years.

Table 1 shows the division in classification between fires in residential buildings, other buildings, and fires outside of buildings. There is also included a total of ninety-seven deaths in response to fire alarms. Over 52% of the loss of life occurred in residential properties. Of these fires over 41% of the victims were children. The number of men and women victims in residence fires was about the same. The next greatest classification occurs in fires outside of buildings, which include bonfires, forest and brush fires, mine, automobile, airplane and other fires that have occurred outside of buildings.

Table 2 gives the detailed occupancy analysis. It is interesting to note that the largest loss of life has occurred in residential properties, including dwellings, apartments, etc. The heavy loss of life in this class is in a large measure due to the combustible construction so largely employed in the buildings used for residence purposes, to the lack of fire protection, and the fact that the majority of these fires occur while the occupants are asleep and are not warned of the fire until too late to make their escape from the burning structure. Also contributing to the large number of fatal fires in dwellings are the numerous fires in which women and children lose their lives due to cloth-

**Table No. 2. Class of Fire.**

| Fires in Buildings: | No. Fires | Men | Women | Children | No Data | Total |
|---|---|---|---|---|---|---|
| Airports and hangars | 7 | 9 | 0 | 0 | 0 | 9 |
| Apartments, hotels, lodgings, tenements, etc. | 307 | 301 | 161 | 133 | 9 | 604 |
| Barns and stables | 35 | 19 | 1 | 24 | 0 | 44 |
| Churches | 10 | 7 | 2 | 4 | 0 | 13 |
| Construction operations | 7 | 17 | 0 | 0 | 0 | 17 |
| Dwellings—Rural | 945 | 357 | 397 | 874 | 11 | 1639 |
| Dwellings—Urban | 865 | 317 | 435 | 417 | 7 | 1176 |
| Fireworks and munitions plants | 24 | 55 | 9 | 4 | 0 | 68 |
| Gas works | 5 | 21 | 0 | 0 | 0 | 21 |
| Garages and filling stations | 45 | 56 | 0 | 3 | 0 | 59 |
| Grain elevators | 11 | 30 | 0 | 0 | 0 | 30 |
| Institutions, schools, etc. | 55 | 135 | 67 | 6 | 4 | 212 |
| Manufacturing occupancies | 151 | 219 | 15 | 6 | 5 | 245 |
| Mercantile occupancies | 76 | 91 | 5 | 1 | 1 | 98 |
| Motion picture theatres | 6 | 8 | 1 | 1 | 0 | 10 |
| Other known buildings | 120 | 111 | 30 | 64 | 0 | 205 |
| **Fires Outside of Buildings:** | | | | | | |
| Airplanes | 171 | 323 | 28 | 6 | 0 | 357 |
| Automobiles | 225 | 267 | 86 | 36 | 10 | 399 |
| Automobile gasoline and oil tank trucks | 15 | 23 | 0 | 3 | 0 | 26 |
| Forest or brush fires | 35 | 62 | 1 | 4 | 0 | 67 |
| Mining property | 47 | 468 | 0 | 0 | 0 | 468 |
| Oil or gas wells | 17 | 51 | 3 | 4 | 0 | 58 |
| Oil refineries and bulk distributing plants | 26 | 59 | 2 | 1 | 0 | 62 |
| Out-of-door fires (bonfires, etc.) | 206 | 88 | 20 | 118 | 1 | 227 |
| Railroad fires | 21 | 57 | 0 | 3 | 0 | 60 |
| Ships and boats | 62 | 163 | 50 | 14 | 0 | 227 |
| Tankers and barges | 15 | 81 | 0 | 0 | 0 | 81 |
| Response to alarms | 73 | 91 | 4 | 2 | 0 | 97 |
| No data | 32 | 41 | 2 | 6 | 0 | 49 |
| Total | 3614 | 3527 | 1319 | 1734 | 48 | 6628 |

ing igniting, improper use of flammable liquids and other similar causes as shown in Table 3.

Despite the greater fire hazard of manufacturing occupancies, it is interesting to note that the average loss of life per fire in school and institution fires has been more than twice as great. This may be explained by the generally inferior fire protection found in school and institution property as compared with the better grade of fire protection, including automatic sprinklers, generally found in the larger manufacturing properties.

In the fires outside of buildings, those occurring in mining property take the greatest toll. Airplane fires and automobile fires come next.

Table No. 3 gives the causes of loss of life. As in the preceding summaries, the classification has been made so as to show the reason for the loss of life rather than the cause of the fire.

The table shows that 1705 persons lost their lives when trapped in burning buildings, the largest number listed under any single item. Deaths are listed in this classification wherever it appears that the victims were trapped in burning buildings, due to the lack of proper exits, etc., irrespective of the initial cause of the fire.

One hundred and seventy-one airplane fires were responsible for 357 fatalities. In a large number of these fires the victims were injured in a crash and were trapped by fire resulting from the crash. Had it not been for fire, these injured persons might have been saved. Deaths obviously due to crash injuries rather than to fire have not been included in this tabulation.

Fires in automobiles, buses, and trucks not including tank trucks were responsible for 399 deaths. The greatest cause of fatal automobile fires was the trapping of occupants in a wrecked or overturned machine following an accident or collision. As was the case with airplanes, most of these fires were due to ignition of gasoline released by the accident. In many cases ignition was due to careless smokers.

Children playing with matches caused one hundred and thirty deaths. A large proportion of the victims of these fires were very small children and some were babies who were burned in fires started by small brothers or sisters. Attention should also be called to the large number of children who were burned to death while left alone even for a short time. Often the reports stated that in a very short time the fire gained such headway that when discovered it was impossible to enter the building to save the children. It is believed that many of these fires were due to children playing with matches or attempting to kindle a stove fire.

Explosions are shown to have been a major cause of loss of life. It is probable that some of the fires here listed as "explosion" were not true explosions, but were fires which spread so rapidly as to appear to be explosions. The predominance of men as explosion victims is explained by the fact that

Table No. 3. Causes of Loss of Life.

| Causes of Loss of Life | Men | Women | Children | No Data | Total |
|---|---|---|---|---|---|
| Airplane fires | 323 | 28 | 6 | 0 | 357 |
| Airplane crashed on house | 8 | 4 | 6 | 0 | 18 |
| Automobile, bus, truck and tractor fires | 267 | 86 | 36 | 10 | 399 |
| Automobile gasoline and oil tank trucks | 23 | 0 | 3 | 0 | 26 |
| Boat and ship fires: | | | | | |
| Motor boat and yacht explosions and fires | 21 | 2 | 1 | 0 | 24 |
| Escaping from boat fire, drowned | 21 | 3 | 7 | 0 | 31 |
| Ship fires (see also flammable liquids, gasoline tank vessels) | 90 | 44 | 6 | 0 | 140 |
| Chemicals and explosives: | | | | | |
| Blasting powder, dynamite and dynamite caps | 21 | 1 | 6 | 0 | 29 |
| Fireworks factories | 12 | 7 | 4 | 0 | 23 |
| Manufacturing of explosives | 31 | 2 | 1 | 0 | 34 |
| Nitrocellulose materials | 11 | 6 | 3 | 1 | 21 |
| Nitroglycerine at oil well | 7 | 3 | 0 | 0 | 10 |
| Miscellaneous chemicals | 7 | 0 | 0 | 0 | 7 |
| Children alone in house | 0 | 0 | 149 | 0 | 149 |
| Children and matches | 0 | 0 | 130 | 0 | 130 |
| Clothing ignited: | | | | | |
| Bonfire, camp fire, rubbish fires | 17 | 12 | 49 | 0 | 78 |
| Candle or torch | 3 | 5 | 2 | 0 | 10 |
| Electrical appliances and heaters | 6 | 11 | 10 | 0 | 27 |
| Fireplace or open grate | 7 | 23 | 18 | 0 | 48 |
| Furnaces, stoves and heaters | 21 | 112 | 36 | 0 | 169 |
| Gas heaters | 3 | 4 | 5 | 0 | 12 |
| Matches | 2 | 9 | 1 | 0 | 12 |
| Oil stove, lamp, and heaters | 9 | 20 | 13 | 0 | 42 |
| Smoking (see also smoking in bed) | 7 | 2 | 0 | 0 | 9 |
| Miscellaneous, clothing ignited | 15 | 5 | 7 | 0 | 27 |
| No data, clothing ignited | 5 | 10 | 5 | 0 | 20 |
| Dust explosions | 39 | 1 | 0 | 0 | 40 |
| Electrical burns | 4 | 0 | 1 | 0 | 5 |
| Entering or re-entering burning buildings | 45 | 31 | 13 | 0 | 89 |
| Escaping from fire—jumped or fell | 22 | 8 | 4 | 0 | 34 |
| Explosions (miscellaneous): | | | | | |
| Acetylene plant or tank | 5 | 0 | 1 | 0 | 6 |
| City gas (including appliances) | 63 | 30 | 14 | 0 | 107 |
| Electrical transformers or switches | 7 | 0 | 1 | 0 | 8 |
| Gas well (natural gas) | 9 | 0 | 0 | 0 | 9 |
| Gas works | 17 | 0 | 0 | 0 | 17 |
| Hexane, soybean processing | 13 | 0 | 0 | 0 | 13 |
| Illicit stills | 18 | 4 | 2 | 0 | 24 |
| Incendiary | 9 | 12 | 3 | 0 | 24 |
| Industrial explosions (miscellaneous) | 32 | 1 | 0 | 3 | 36 |
| Miscellaneous explosions | 29 | 10 | 9 | 0 | 48 |
| Unknown explosions | 12 | 6 | 0 | 1 | 19 |
| Fire fighting | 166 | 6 | 0 | 0 | 172 |
| Fireworks | 10 | 1 | 17 | 1 | 29 |
| Flammable liquids and vapors: | | | | | |
| Alcohol explosions and fires | 7 | 0 | 3 | 0 | 10 |
| "Empty" tanks (welding, children playing with, etc.) | 4 | 0 | 1 | 0 | 5 |
| Flammable liquids on clothing—open flame | 5 | 2 | 3 | 0 | 10 |
| Gasoline distributing stations | 11 | 0 | 0 | 0 | 11 |
| Gasoline stoves or lamps | 12 | 18 | 27 | 6 | 63 |
| Gasoline tank vessels and barges | 77 | 0 | 0 | 0 | 77 |
| Gasoline torches | 5 | 0 | 2 | 0 | 7 |
| Heating flammable liquids on stoves | 4 | 5 | 8 | 0 | 17 |

*Table continued on next page*

Table 3. Causes of Loss of Life (Continued).

| Causes of Loss of Life | Men | Women | Children | No Data | Total |
|---|---|---|---|---|---|
| Flammable liquids and Vapors (continued) | | | | | |
| Home dry cleaning | 17 | 71 | 14 | 0 | 102 |
| Other cleaning with gasoline | 6 | 2 | 3 | 0 | 11 |
| Oil furnace explosion | 4 | 0 | 0 | 0 | 4 |
| Oil refinery explosion | 56 | 2 | 1 | 0 | 59 |
| Oil stoves, lamps and lanterns | 35 | 47 | 37 | 0 | 119 |
| Oil well | 23 | 0 | 0 | 0 | 23 |
| Starting fires with gasoline | 23 | 23 | 43 | 2 | 91 |
| Starting fires with kerosene | 62 | 102 | 131 | 0 | 295 |
| Miscellaneous gasoline fires and explosions | 123 | 33 | 49 | 0 | 205 |
| Miscellaneous (other than gasoline) | 23 | 6 | 13 | 1 | 43 |
| No data as to flammable liquid involved | 2 | 1 | 0 | 0 | 3 |
| Forest fires (including fire fighting) | 62 | 1 | 4 | 0 | 67 |
| Mine fires and explosions* | 455 | 0 | 0 | 0 | 455 |
| Motion picture film ignited | 6 | 6 | 13 | 0 | 25 |
| Overcome by smoke — suffocation | 110 | 79 | 73 | 9 | 271 |
| Overexertion, shock or excitement | 46 | 24 | 0 | 0 | 70 |
| Railroad fires | 57 | 0 | 3 | 0 | 60 |
| Response to alarms | 91 | 4 | 2 | 0 | 97 |
| Smoking in bed | 80 | 28 | 0 | 0 | 108 |
| Trapped in burning buildings | 645 | 334 | 712 | 14 | 1705 |
| Trapped starting incendiary fire | 7 | 0 | 0 | 0 | 7 |
| Miscellaneous known causes | 21 | 0 | 5 | 0 | 26 |
| No data | 10 | 22 | 18 | 0 | 50 |
| Total | 3527 | 1319 | 1734 | 48 | 6628 |

*The number of fatalities in mine fires and explosions in Table 3 is less than the number given for the occupancy in Table 2 because thirteen of the deaths in mines were attributable to other causes, such as fire fighting, entering mine for rescue attempts, etc.

many of these accidents occurred in manufacturing plants, mines, and other properties where most of the employees are men.

Outstanding among the causes of fatal dwelling fires is the use of flammable liquids. Ninety-one persons were killed as a result of using gasoline to start fires in stoves. Some of these victims believed that they were using kerosene, but others were ignorant or foolish enough to use gasoline deliberately. Kerosene used in a similar manner was responsible for 295 deaths. In some instances live coals remained in the stove, and vaporized kerosene flashed or exploded. The use of flammable liquids for home dry cleaning was responsible for 102 deaths, mostly women, and again emphasizes the seriousness of this hazard. Use of flammable liquids for other purposes, including use as fuel, resulted in numerous other fatalities as shown in Table 3, under the heading "Flammable liquids and vapors."

Another outstanding cause of loss of life is listed as "Overcome by Smoke—Suffocation." In most instances the victims were overcome while asleep. Heat rising from a fire below often caused the death of victims who were not touched by fire.

# Fires in Which There Was Loss of Life.

## Fourth Quarter, 1935.

Since the publication of the October QUARTERLY, the N.F.P.A. Department of Fire Record has received from various sources 165 reports of fires in which there has been loss of life. A total of 285 lives were lost in these fires. During the period the following fires were reported in the United States and Canada, which caused the loss of more than five lives each.

SEPTEMBER 29, 1935. CHICAGO, ILL. Ten persons, including two women and six children, were trapped in the three-story brick tenement in which they were sleeping by an incendiary fire started with gasoline in the basement. The owner of a grocery store on the first floor of the building hired a "torch" to start a fire so that he might collect insurance money.

OCTOBER 7, 1935. CHICAGO, ILL. Eleven men were killed and forty-five others were injured by an explosion at a soybean processing plant (see page 233 of this issue of the QUARTERLY).

## Loss of Life Fires, October-December, 1935.*

*This is a typical rather than a complete record, presented to show the conditions under which loss of life occurs, that they may be known and guarded against. The total loss of life by fire in the United States is estimated at 10,000 annually.*

| | No. Fires | Men | Women | Children | Total |
|---|---|---|---|---|---|
| Airplane fires | 4 | 9 | 0 | 0 | 9 |
| Apartments, hotels, lodgings, tenements, etc. | 16 | 9 | 13 | 13 | 35 |
| Automobile fires | 11 | 10 | 3 | 0 | 13 |
| Automobile tank truck collisions | 2 | 5 | 0 | 1 | 6 |
| Barns | 2 | 0 | 0 | 5 | 5 |
| Construction operations | 2 | 3 | 0 | 0 | 3 |
| Dwellings—Rural | 46 | 16 | 16 | 43 | 75 |
| Dwellings—Urban | 47 | 15 | 20 | 33 | 68 |
| Garages | 3 | 4 | 0 | 0 | 4 |
| Industrial | 5 | 16 | 0 | 0 | 16 |
| Institutions | 2 | 5 | 2 | 0 | 7 |
| Mining property | 3 | 19 | 0 | 0 | 19 |
| Oil distributing plants | 1 | 1 | 0 | 0 | 1 |
| Other buildings | 9 | 11 | 0 | 0 | 11 |
| Outside of buildings | 5 | 1 | 1 | 3 | 5 |
| Railroad fires | 1 | 1 | 0 | 0 | 1 |
| Response to alarms | 1 | 1 | 0 | 0 | 1 |
| No data | 5 | 3 | 2 | 1 | 6 |
| Total | 165 | 129 | 57 | 99 | 285 |

*This table is made up from those reports received by the Department of Fire Record between September 18, 1935, and December 18, 1935. A few of the fires included herein occurred prior to September 18, but were not reported until subsequent to that date.

# Causes of Loss of Life, October-December, 1935.

*Fatalities classified according to the immediate cause of the loss of life rather than according to the cause of the fire.*

| Cause | Men | Women | Children | Total |
|---|---|---|---|---|
| Airplane fires | 9 | 0 | 0 | 9 |
| Automobile and truck fires | 10 | 3 | 0 | 13 |
| Automobile tank truck collisions with automobiles or trains | 5 | 0 | 1 | 6 |
| Children alone in house | 0 | 0 | 12 | 12 |
| Children playing with matches or fire | 0 | 0 | 4 | 4 |
| Clothing ignited: | | | | |
| Bonfire | 0 | 0 | 1 | 1 |
| Candle | 0 | 2 | 0 | 2 |
| Fireplace or open grate | 0 | 0 | 2 | 2 |
| Furnaces, stoves and heaters | 0 | 11 | 0 | 11 |
| Jack-o'-lantern | 0 | 0 | 2 | 2 |
| Stirring paint in factory | 1 | 0 | 0 | 1 |
| No data, clothing ignited | 0 | 3 | 0 | 3 |
| Entering or re-entering burning buildings to save life | 2 | 2 | 1 | 5 |
| Explosions (Miscellaneous): | | | | |
| City gas | 2 | 5 | 1 | 8 |
| Hexane, soybean processing | 13 | 0 | 0 | 13 |
| Tar pot | 1 | 0 | 0 | 1 |
| Vulcanizing machine | 1 | 0 | 0 | 1 |
| Unknown explosions | 1 | 0 | 0 | 1 |
| Fire fighting—firemen | 2 | 0 | 0 | 2 |
| Flammable liquids and vapors: | | | | |
| Explosion of liquid used in cleaning paint brushes | 1 | 0 | 0 | 1 |
| Gasoline ignited maliciously | 1 | 0 | 0 | 1 |
| Gasoline lamp or stove | 0 | 2 | 0 | 2 |
| Gasoline storage tank overflowed | 1 | 0 | 0 | 1 |
| Gasoline tank exploded by acetylene torch | 1 | 0 | 0 | 1 |
| Gasoline thinner in tank waterproofing process ignited | 2 | 0 | 0 | 2 |
| Gasoline used to burn ant hills | 0 | 0 | 1 | 1 |
| Gasoline used to clean walls | 1 | 0 | 3 | 4 |
| Gasoline-fired steam generator for removing wall paper, explosion | 2 | 0 | 0 | 2 |
| Gasoline motor operated washing machine, explosion | 0 | 1 | 3 | 4 |
| Gasoline explosion—no data | 3 | 0 | 0 | 3 |
| Japan fumes ignited by careless smoker | 1 | 0 | 0 | 1 |
| Kerosene can fell on stove | 0 | 0 | 1 | 1 |
| Motor fuel oil exploded by overheated machinery | 1 | 0 | 0 | 1 |
| Oil in melting pot ignited | 1 | 0 | 0 | 1 |
| Oil stove or lamp explosion | 2 | 0 | 0 | 2 |
| Starting fire with gasoline | 1 | 0 | 0 | 1 |
| Starting fire with kerosene | 3 | 5 | 11 | 19 |
| Warming gasoline soaked hands over fire | 0 | 0 | 1 | 1 |
| Mine fires and explosions | 19 | 0 | 0 | 19 |
| Overcome by smoke—suffocation | 4 | 5 | 7 | 16 |
| Overexertion, shock or excitement | 1 | 0 | 0 | 1 |
| Railroad fires | 1 | 0 | 0 | 1 |
| Response to alarms | 1 | 0 | 0 | 1 |
| Smoking in bed | 8 | 1 | 0 | 9 |
| Smoking while driving load of hay | 1 | 0 | 0 | 1 |
| Trapped in burning buildings | 22 | 12 | 36 | 70 |
| Trapped in incendiary fires | 1 | 4 | 12 | 17 |
| No data | 3 | 1 | 0 | 4 |
| Total | 129 | 57 | 99 | 285 |

NOVEMBER 3, 1935. NEW YORK, N. Y. A mother and five children were burned to death when trapped in their fourth floor apartment of an "old-law" tenement by a fire of incendiary origin. The fire started under the stairs on the first floor and cut off the escape of tenants, who were taken down ladders by firemen. The father of the trapped family escaped, but failed to tell firemen of his family's plight and they thought that they had saved all the occupants until the bodies were found after the fire was extinguished.

NOVEMBER 28, 1935. FORT WORTH, TEXAS. One man, four women and one child lost their lives and eleven persons were injured when an explosion of a gas heater in a bedroom sent flames through a two-story frame apartment building. It is believed that gas which had escaped during the night exploded when a match was struck to light the heater.

DECEMBER 9, 1935. COALHURST, ALTA. Sixteen men were trapped and killed by a gas explosion in a coal mine. The explosion occurred a mile within the mine at the six hundred foot level. Three other miners near the source of the explosion escaped with severe burns.

DECEMBER 15, 1935. CARNEGIE, OKLA. A man and five children were burned to death and two other persons were severely burned when an early morning fire attributed to a defective flue swept the four-room frame farmhouse. Five of the thirteen occupants of the small house escaped uninjured.

## Typical Loss of Life Fires.

### Children Alone in House.

L-3186. BROOKLYN, N. Y., OCTOBER 26, 1935. Two children were burned to death and two others were severely injured in a fire which occurred while their mother was out marketing. The children had discovered a fire under the stairs, but thought that they had extinguished it and resumed their play. The fire had cut off their escape before they realized that it had rekindled.

L-3187. PITTSFIELD, MASS., NOVEMBER 1, 1935. A two-year-old boy was burned to death in a fire which occurred while seven children were alone at home under the care of the oldest child, who was eleven. The father was at work and the mother and another child had gone to church. The fire started on the rear porch and appeared to have considerable headway when discovered. Six children escaped, but the body of the youngest child was found in the pantry, where he had apparently attempted to hide.

L-3208. VERDUN, P. Q., DECEMBER 7, 1935. A baby, one of four children left alone in the house while their mother was buying groceries, was fatally burned when his five-year-old brother threw a lighted paper into the cradle. The older child had been playing with paper near the stove when it ignited. A boy passing the house saw the flames, rushed in and beat out the fire with a coat and took the baby to his own home, from which it was removed to a hospital. Pneumonia developed and the infant died in a few hours.

**Fighting Automobile Fire.**

L-3207. CHELSEA, MASS., DECEMBER 6, 1935. A fire department officer was fatally burned by a gasoline tank explosion while fighting a fire in an automobile truck. The cab of the truck was badly involved when firemen arrived and while a hose line was being run the officer stood directly opposite the blazing cab. Without warning the gasoline tank, which was located above the dash board, exploded, and struck the victim on the shoulder, instantly covering him with blazing gasoline. Another fireman was severely burned in beating out the flames on the officer's clothing.

**Flammable Liquids and Vapors.**

L-3204. LYNN, MASS., NOVEMBER 25, 1935. A man was fatally burned and died ten days later in a hospital as the result of the explosion of gasoline from the tank of an automobile which he was dismantling with an acetylene torch. The victim was working under the car.

S-70652. LYNN, MASS., DECEMBER 12, 1935. A young factory employee was fatally burned when he dropped a lighted match, which he used in "stealing a smoke," near an open paint container filled with japan. Fumes from the japan flashed, igniting the victim's clothing, and he ran from the building a living torch. Automatic sprinklers quickly extinguished the burning japan and it is thought that had he not run outside in panic the victim might have been saved.

**Kerosene Used to Start Fire.**

L-3183. KEMPTVILLE, ONT., SEPTEMBER 29, 1935. A woman was severely burned and died two days later in a hospital to which she was taken as the result of an attempt to use kerosene to start a furnace fire in her home. When her clothing ignited she ran outside and rolled in the grass in an effort to smother the flames, but was fatally burned.

L-3189. MILBANK, S. D., NOVEMBER 9, 1935. A woman was fatally burned when a small can of kerosene kept on the warming oven of the kitchen stove for use in kindling fires in the range was overturned on the stove and ignited. Her husband smothered the flames with blankets, but not in time to prevent fatal burns.

**Overcome by Smoke — Suffocation.**

L-3190. HAVERHILL, MASS., NOVEMBER 13, 1935. One man was suffocated in his bedroom and two other persons were carried out unconscious and revived when smoke from a rubbish fire in the basement filled a three-story frame rooming house.

L-3198. NAHANT, MASS., NOVEMBER 22, 1935. A three-year-old girl was suffocated by an early morning fire in her home caused by the ignition of clothing hung over the kitchen range. The father carried out a baby and two other children, but was prevented by smoke from reaching the victim.

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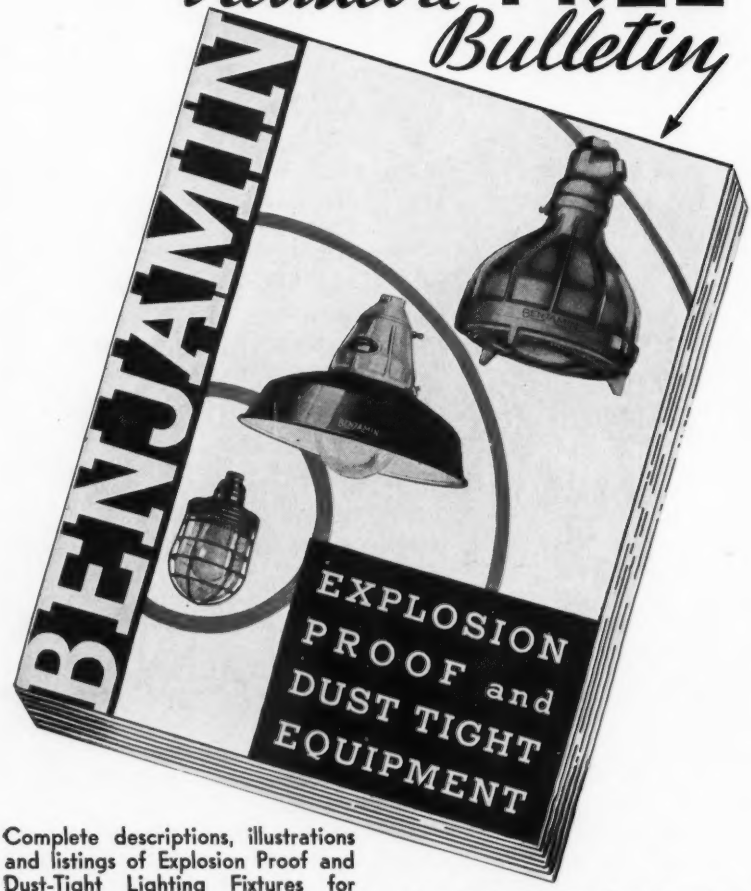


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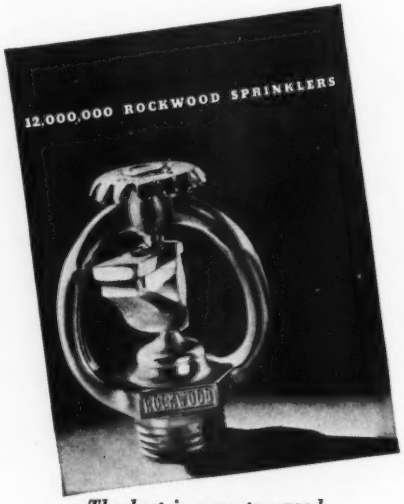


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CITY of LENOIR
NORTH CAROLINA

OFFICE OF FIRE DEPARTMENT.
August 2nd, 1935

Mr. Chas. Berst,
District Sales Manager,
The Gamewell Company,
510 Peters Building,
Atlanta, Ga.

Dear Mr. Berst:

The installation of our Gamewell Fire Alarm System was completed and the system placed in operation March 27th, 1935. We have 93 Gamewell Fire Alarm Boxes in use in a city of approximately 7,000 population.

Since the installation we have had 100% box alarms, which we feel is unusual for a city that has always depended on the telephone for reporting fires.

From March 27th. to August 1st, 1932 we had $309 000. worth of property at risk and a loss of $96.000. For the same period in 1933 we had $75,900. at risk and a loss of $42,420. In 1934 during a corresponding period, we had $96,200. at risk and a loss of $45,066 For this same period in 1935, or in other words since the Gamewell System was installed to date, we have had $1,254,250. of property at risk and a loss of only $581.

Our explanation of this small loss is that every alarm we have received has been a box alarm, which was fast and accurate, enabling us to get on the job more quickly, and thereby keep the loss low.

We are extremely proud of our low loss ratio and the fact that all our alarms have been box alarms The Gamewell Fire Alarm System is fast, accurate, and dependable.

This letter is sent to you without solicitation.

Yours very truly,
Lenoir Fire Department
A. T. Cottrell,
Capt. of Alarms.

**Lenoir, N. C., has just provided us with a striking example of the value of a Gamewell municipal fire alarm system that should be of interest to every fire insurance official. During a four months period they received 100% box alarms, which reduced their fire losses to $581 against an average four months fire loss of $61,162 for the three years prior to the installation of the new system, when the city relied entirely on telephones for the transmission of fire alarms.**

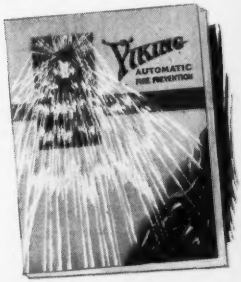
**Adequate fire alarm box distribution played an important part in producing such a high percentage of box alarms. Lenoir, with a population of about 7000, has 93 Gamewell fire alarm boxes on its streets. If you are interested, write for a copy of our booklet NF700, telling how to plan fire alarm box distribution.**

# THE GAMEWELL COMPANY
## NEWTON, MASSACHUSETTS

# VIKING FIRE PREVENTION SERVICE *available from Coast to Coast*

**CALL ON VIKING . . . whenever you have need of the services of a fire prevention engineer. Viking welcomes every opportunity to be of service in furthering the cause of fire prevention. Without obligation, Viking engineers will make surveys and insurance cost analyses for owners of industrial and business properties; co-operate with progressive insurance men who are interested in providing complete insurance at the lowest possible cost; aid fire prevention organizations in every possible way. Please do not hesitate to call on Viking.**

Why Sprinkler Protection and what kind? This booklet answers these and many other questions—should be in the file of everyone interested in fire prevention — a copy on request.




VIKING

## AUTOMATIC SPRINKLER SYSTEMS

**3 Separate Systems**

the Viking Dry Pipe, Wet Pipe and Pre-Action & Deluge Systems provide the exact type of protection required by the risk. Viking Deferred Payment Plan enables the purchaser to pay for System out of insurance savings.

**VIKING COMPANIES:**

**Atlanta, Ga.-Charlotte, N. C.—Crawford & Slaten Co.**
**Boston, Mass.—Viking Automatic Sprinkler Co.**
**Buffalo-Syracuse, N. Y.—Viking Automatic Sprinklers, Inc.**
**Chicago, Ill.—Viking Automatic Sprinkler Co.**
**Cincinnati-Cleveland, Ohio—Viking Sprinkler Co.**
**Dallas-Houston, Texas—Texas Automatic Sprinkler Co.**
**Detroit, Mich.—Viking Sprinkler Co.**
**Grand Rapids, Mich.—Viking Automatic Sprinkler Co.**
**Huntington, W. Va.—C. W. Hutchinson, Inc.**
**Indianapolis, Indiana—Indiana Automatic Sprinkler Co.**
**Kansas City-St. Louis, Mo.—Walton-Viking Co.**
**Los Angeles-San Francisco, Cal.—Viking Automatic Sprinkler Co.**
**Minneapolis, Minn.—Viking Automatic Sprinkler Co.**
**New York, N. Y.—Viking Automatic Sprinklers, Inc.**
**Philadelphia, Pa.—Viking Sprinkler Co. of Pa.**
**Seattle, Wash.-Portland, Ore.—Viking Automatic Sprinkler Co.**
**Toronto, Ontario—Toronto Viking Sprinklers, Ltd.**

## THE VIKING CORPORATION

**HASTINGS, MICHIGAN**

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## This time they got the alarm IMMEDIATELY

Less than a year ago a Washington, D. C. jewelry establishment suffered a heavy loss from an unusually disastrous fire. Not believing in the adage that "lightning never strikes twice in the same place," the proprietors determined that they no longer would leave their fire protection to Chance. Within a week of the disaster they contracted for A.D.T. "Aero" Automatic Fire Alarm Service.

On September 3, fire again broke out in the same place . . . but this time, "Aero" was there to detect the blaze *when it started.* The fire department, summoned instantly and automatically, extinguished the blaze without difficulty. However, since the basement was filled with packing cartons, wooden boxes and other highly inflammable material, the fire would have reached most serious proportions, given a few minutes headway.

In a letter to A.D.T., the subscriber declared: "It is unquestionably the promptness with which "Aero" detected the blaze that saved everything. I want to tell you that I can sleep better knowing that we have this system installed in our establishment."

### "AERO" ELIMINATES THE HAZARD OF BELATED DISCOVERY

The A.D.T. "Aero" Automatic Fire Alarm System prevents small blazes from becoming big ones, because it automatically detects fire *when it starts,* and instantly and automatically summons the fire department. The system can be installed anywhere in the United States. To fire chiefs who wish to encourage quick and accurate alarms, we offer illustrated booklets giving complete information regarding this and other A.D.T. Protection Services.

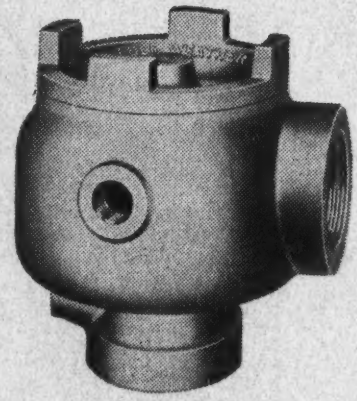
**A. D. T. Protection Services**

WATCHMAN SUPERVISORY AND MANUAL FIRE ALARM SERVICE : : : BURGLAR ALARM : : : HOLDUP ALARM
SPRINKLER SUPERVISORY AND WATERFLOW ALARM SERVICE : : : "AERO" AUTOMATIC ALARM SERVICE

Controlled Companies of AMERICAN DISTRICT TELEGRAPH COMPANY • 155 SIXTH AVENUE, NEW YORK, N. Y.

A.D.T. SYSTEM — A NATION-WIDE PROTECTION SERVICE AGAINST FIRE, BURGLARY AND HOLDUP — A·D·T

# *WHY Risk The Entire Property?*



*(Patent Applied For)*

## THE COLD WEATHER VALVE

**Converts a Section of a Wet System Into a Dry one**

**Insures 100% Protection In Winter**

No longer is it necessary to risk the danger of fire menacing an entire plant simply because a section of the wet pipe sprinkler system has been shut off to prevent freezing in an unheated section of the premises during the winter months.

The Cold Weather Valve has been developed by the Automatic Sprinkler Industry, in coöperation with the Insurance Companies to enable property owners to safeguard themselves against this hazard. It performs the same service for small, unheated systems that dry pipe valves render freezing areas in large systems. Manufactured in the 2" size only, it insures 100% protection by the automatic sprinkler system during the entire year.

The Cold Weather Valve has been approved by Underwriters' Laboratories and Factory Mutual Laboratories.

**GRINNELL COMPANY**
INC.

EXECUTIVE OFFICES

PROVIDENCE RHODE ISLAND

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Offices in all Principal Cities of the United States and Canada.